

The Beginnings of Modern Transport in France:
The Seine Valley, 1820 to 1860

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ABSTRACT

This is a study of the system of intercity goods transport between Paris and LeHavre. Between 1820 and 1860 horse-drawn road and river transport were replaced by a railway and steamers operating in an improved river channel. In the 1820s there was an unsuccessful attempt to build a maritime canal to Paris. Owing to the advance of railway technology and to innovations in transport on the Seine, the project was dropped. Steam was first effectively applied to river transport in 1826 by the use of tugboats. Operating at first only between LeHavre and Rouen, these were first used from Rouen to Paris during the 1830s. Statistics of port and river traffic show that during the late 1830s goods moving by river and by road in the lower Seine valley increased more rapidly than in the past. During this decade there were several attempts to initiate construction of a railway from Paris to LeHavre. These were complicated by controversy over which route it should follow, and for this and other more general economic reasons, these attempts failed. A successful company was formed in 1840 to build a railway from Paris to Rouen. One third of its total capital came from Great Britain. This line was completed in 1843 and extended to LeHavre in 1847 and Dieppe in 1850. Using statistics of river traffic and railway financial data, the competition which followed is analyzed. Goods traffic by road was largely absorbed by the railway by 1850. River-borne traffic was at first little affected, though the revenues of boat operators was reduced. Extension of the railway to LeHavre and the general economic crisis from 1847 to 1849 created a crisis in river transport. Satisfactory means had been found for canalization of the Seine, and owing to the threat to river transport from the railway, this programme was accelerated in the mid-1840s. During the first years of the 1850s prosperity brought large traffic to all modes of transport. In 1854 the transport of wines, traditionally carried by river transport from Rouen to Paris was diverted to a newly completed railway line from Bordeaux to Paris. This and other new sources of competition tended to slow the growth of railway traffic. New faster steamers helped river transport to retain a large share of the total traffic. By 1860 the railway was carrying less than half the goods traffic from LeHavre to Rouen, and somewhat more than half of that from Rouen to Paris.

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INTRODUCTION

Relatively little has been written about the development of transport in France. The few general histories available, by Cavaillès and Dauzet¹ for example, are rather unsatisfactory. This is not to say that outstanding scholars have not interested themselves in this subject, and produced work of value. The writings of Maurice Jouffroy² and Marcel Blanchard,³ and more recently of Louis Girard,⁴ François Caron⁵ and Bertrand Gille⁶ are worthy of very close study. Most of what these and other writers have published however, has been concerned primarily with the planning and construction of railways which was begun during the July Monarchy and continued through the Second Empire. Very little attention seems to have been given to the vast programmes of improvement to the nation's waterways and roads which were begun during the Restoration and cut short by the beginning of the railway era. These programmes were of consuming interest to contemporaries, and they absorbed very large sums of money. Even after railways became the main subject of interest, governments continued to spend large amounts for improvement of some waterways and roads. What was the effect upon these programmes begun in earlier decades of the rapid advance of railway technology? What was the effect upon other modes of transport of the progress of railways?

The study contained herein is an attempt to answer these questions within the confines of a small part of France's transport system, albeit a very important one. Louis Girard has written that "the process of invention and innovation in transport has...a rhythm and internal logic of its own".⁷ This study is an attempt to describe with completeness and in detail the whole process of change in a transport system, taking into account all of the important modes of transport. It begins two decades before the advent of railways, one decade before they were even being seriously mentioned. The system of transport in the lower Seine valley was the principal one feeding Paris from overseas and from the very large coasting trade; it was therefore of great

importance. It had a prominent place in most attempts to improve the nation's transport system, and the railway built there was one of the very earliest long inter-city lines built in France. During the four decades studied, from 1820 to 1860, this system underwent almost complete change. Horse-drawn road vehicles and river vessels were replaced by a railway and by steamships operating on a greatly improved river.⁸

* * *

I should like to acknowledge the generous assistance of the British Council, the Canada Council and the University of London Central Research Fund, and the indulgence of the Canadian Ministry of Transport; without these the chapters to follow could never have been written.

PART ONE

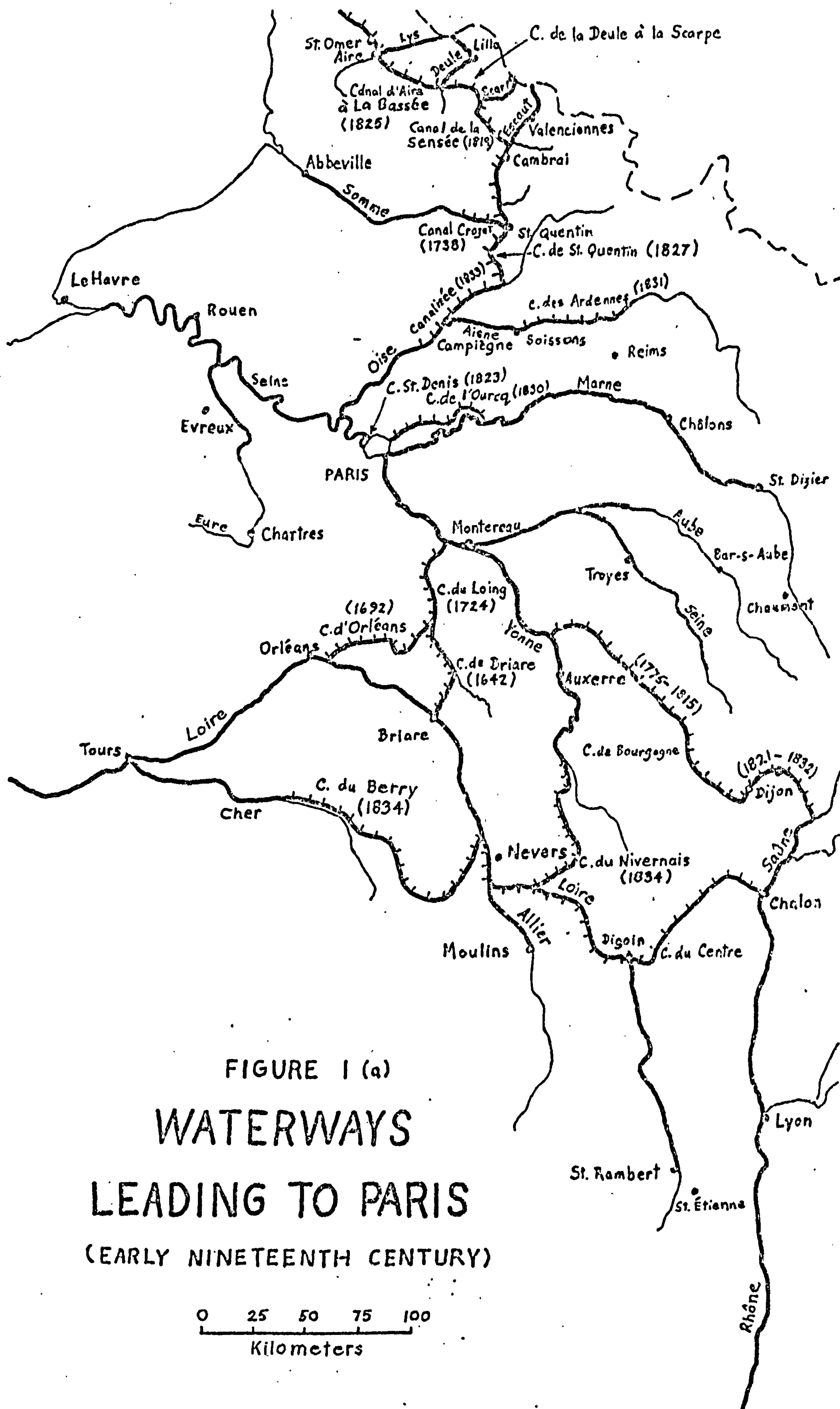
Transport was a subject which attracted great interest in France during the 1820s, and this decade was very fertile in ideas for improving the transport system. This interest and some of these ideas were stimulated in part by the remarkable development which had been taking place in other countries, particularly in Great Britain. They also had independent roots in the later years of the previous century; their fulfillment at that time had been cut short by the Revolution. In the valley of the Seine and in some other parts of France there was an increasing demand for faster and more economical inter-city goods transport. There was a remarkable number of ideas put forward for meeting this demand. From among these emerged most of the few important innovations which were to dominate the transport system during the remainder of the century. The State played only a small role in this process. Its energies were directed toward reviving ideas and completing programmes which had been of greater importance in the past than they would be in the future. The State was concerned largely with expanding the system of artificial waterways, and with finding means for improving the country's roads. In neither was it notably successful during the 1820s. The motive force behind most of the important innovations in this decade, and in the rest of the century, was steam power. In the Seine valley and everywhere else in France, the decade began with the traditional system of transport unaltered. This system depended entirely upon natural (animal, human and 'meteorological') sources of power. Through the modest efforts of small private entrepreneurs, by the end of the decade steam power had been successfully applied to river transport, and the elements needed for its application to railway transport had been perfected.

CHAPTER ONE

Trade and Transport in the Early 1820s

Paris had a very large part in the considerable flow of trade which took place in France during the early decades of the nineteenth century. Although it was not then the predominant centre of economic activity it has since become, its very large and densely concentrated population was a voracious consumer of goods of all kinds. It lay at the centre of an extensive transport system of radiating roads and waterways (shown in Figure 1), feeding it from all directions. These roads and waterways were very heavily used, bringing into Paris an amount of goods probably in excess of two million tons per year in the early 1820s.

Among the largest cities of Europe, Paris alone was not a seaport. With its relatively good inland communications it had been able to develop away from the sea. Though often shallow, uneven and unreliable, and always very slow, the system of radiating navigable waterways extended hundreds of kilometres from Paris, giving access not only to the surrounding regions of Burgundy, the Champagne, the Orléanais, Ile-de-France, Picardie and Normandy, but also to places farther afield. In 1823 over 16,000 boats arrived in Paris, bringing an estimated 600,000 tons of goods; to this were added almost 7,000 rafts of timber and firewood, amounting to another 860,000 tons.¹ Vast quantities of firewood, timber and charcoal, as well as wines, fish and other goods came down the Yonne, one of the busiest waterways. Smaller quantities of wine, grain and iron came from the lower reaches of the Aube. The Marne was deeper, and bateaux marnois of up to 250 tons navigated down from as far as St.-Dizier, over 340 kilometres from Paris. Shallower and narrow canals fed goods into the upper Seine from the Loire. A hundred or so small boats and over 2,000 toues brought timber and firewood from the upper Loire, wines from Burgundy, the Orléanais and even from Languedoc and Rousillon (via the Canal du Centre) and a few colonial goods from the port of Nantes.



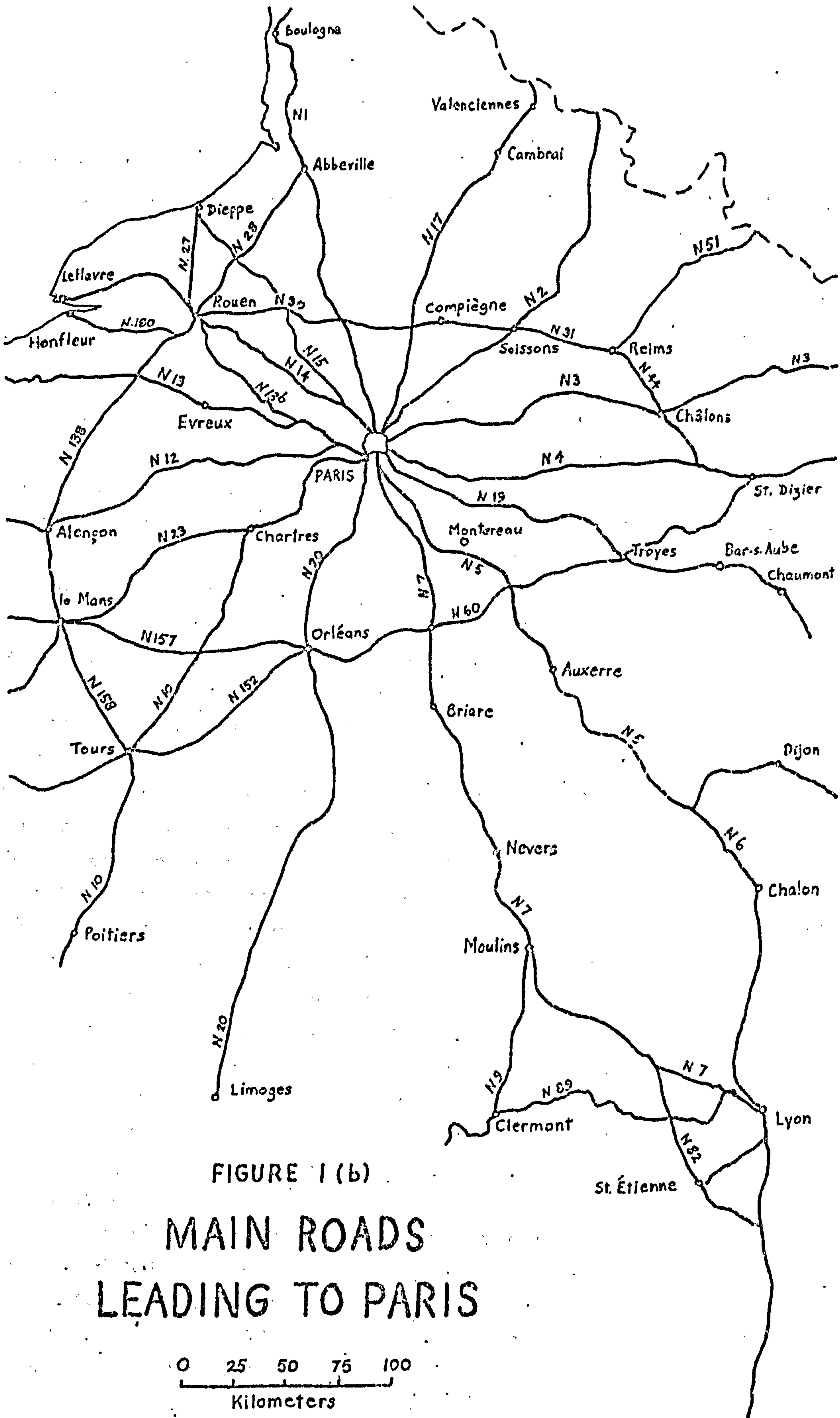


FIGURE 1 (b)

MAIN ROADS
LEADING TO PARIS

0 25 50 75 100
Kilometers

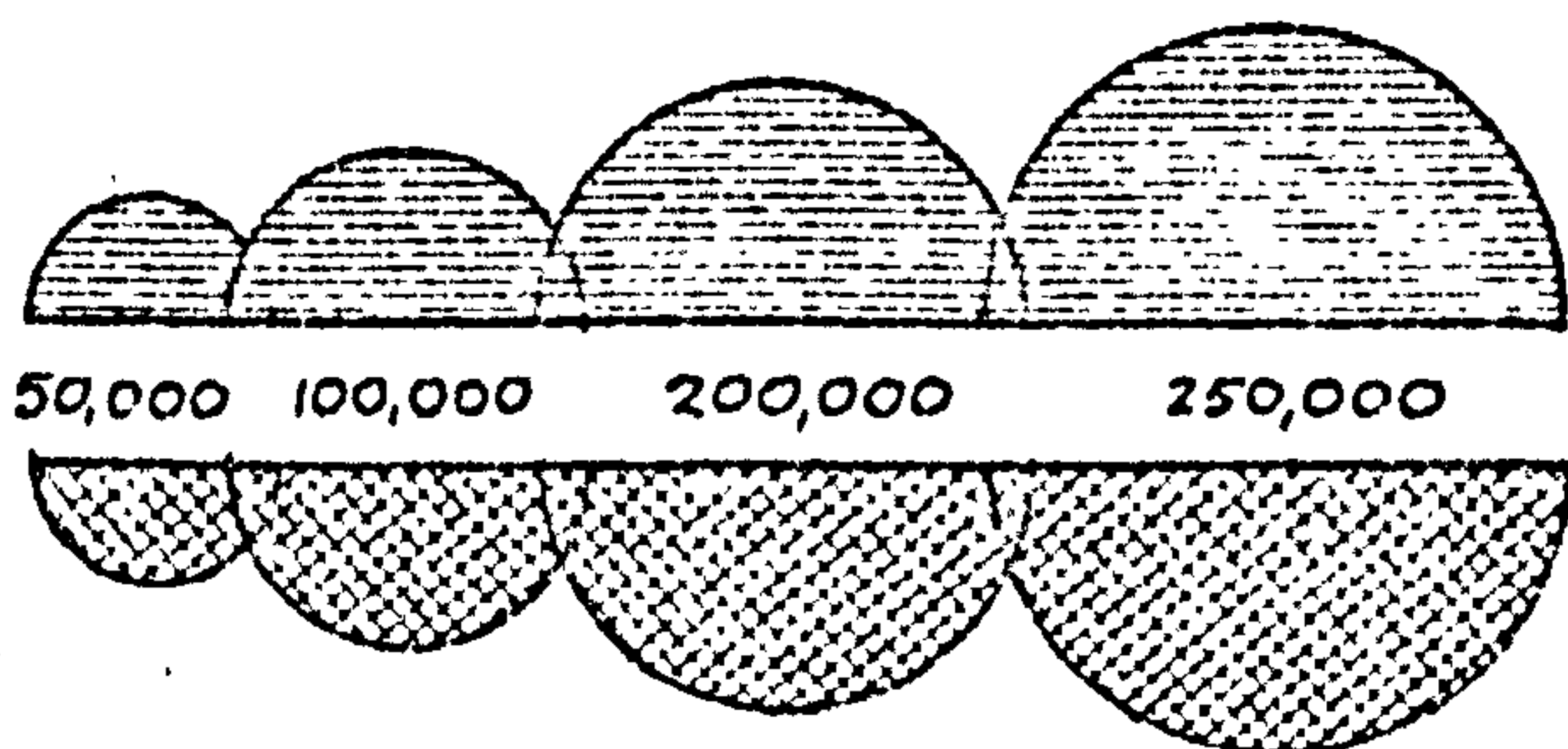
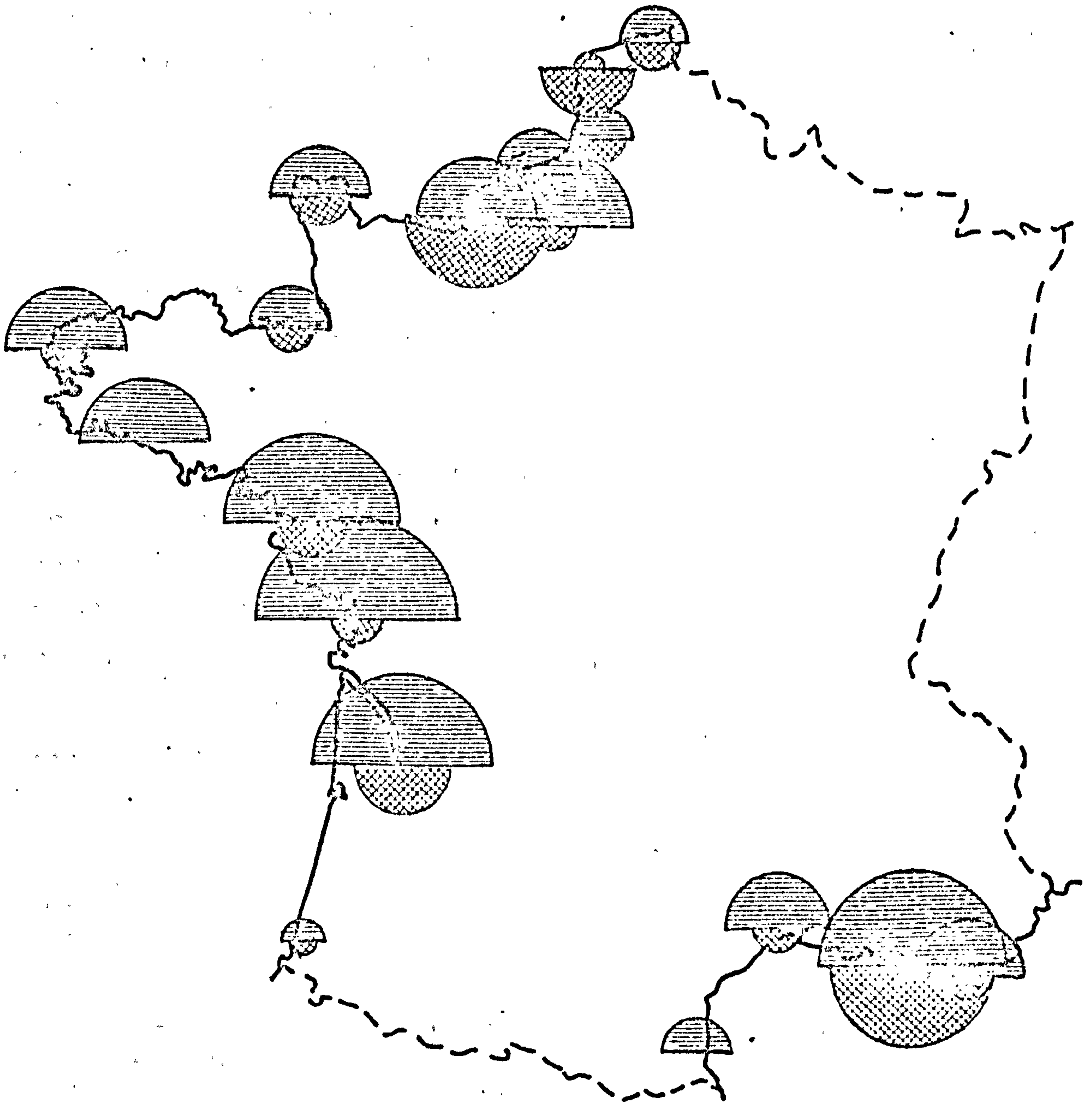
Down the Oise to the Seine at Conflans came thousands of tons of firewood and charcoal from the Aisne, coal from the north, grain and hay from Picardie. Finally, out to the west flowed the Seine, and up its slowly meandering current from Rouen and LeHavre came goods from the coasting trade, the colonies and abroad. For these Paris was almost entirely dependant upon the Seine.

The Lower Seine Valley: the Road to Paris from the Sea.

Sea transport played a very large role in domestic as well as in foreign commerce, a fact that few historians have thought to stress. Although the volume of goods arriving in the seven major ports of Paris exceeded by far that at any seaport, it is evident from Figure 2 that seaborne trade was considerable. Where possible, owing to the high cost of inland transport, merchants used the coasting trade, especially for bulky goods such as stone, wood, wine, salt and oils. The easiest access to Paris from many parts of the country -- all the Midi, the Bordelais, Charente, Brittany, lower Normandy -- was by sea. Goods flowed out of the interior to the ports by road and waterway, were carried around the coast to other ports, trans-shipped and carried once more by inland transport to their final destinations. A very large part of foreign trade and all but a very small proportion of colonial trade to Paris were also carried by sea. Access by Paris to both foreign and domestic ports was almost entirely by way of the lower Seine. It should also be mentioned that such goods as raw cotton, coffee, sugar and a few other denrées coloniales used in the industrial regions of northeast France, Switzerland and south Germany came partly by way of the lower Seine ports.

Among the several waterways feeding Paris therefore, the lower Seine was certainly one of the most important and one of the most heavily used. The lower Seine was not entirely devoted to its function as the road to Paris from the sea, but very little of what arrived in Paris from downstream came from the towns above Rouen, or even from the little ports toward LeHavre. In 1824 some 150,000 tons of goods moved upstream by water from Rouen and LeHavre to Paris,² and another 50,000 tons were carried by road. Downstream traffic by water was almost 190,000 tons, by road almost 26,000 tons. From the coasting trade to Paris came large quantities of wines and spirits, timber, salt,

SEABORNE TRADE 1825



Coasting Trade

INBOUND SHIPPING (Net Registered tons)

Foreign Trade

chemicals, soap, metals, stone and other goods. From the colonies and abroad came more metals, chemicals, timber, and such goods as bois d'ébenisterie, sugar, cotton, dyestuffs, hides and coffee. On the return journey the principal commodities carried to Rouen were wines (from Burgundy and the Champagne), plaster (from Treil and Vaux), stone, grain, and much smaller quantities of semi-manufactured goods and articles de Paris for local consumption and export.

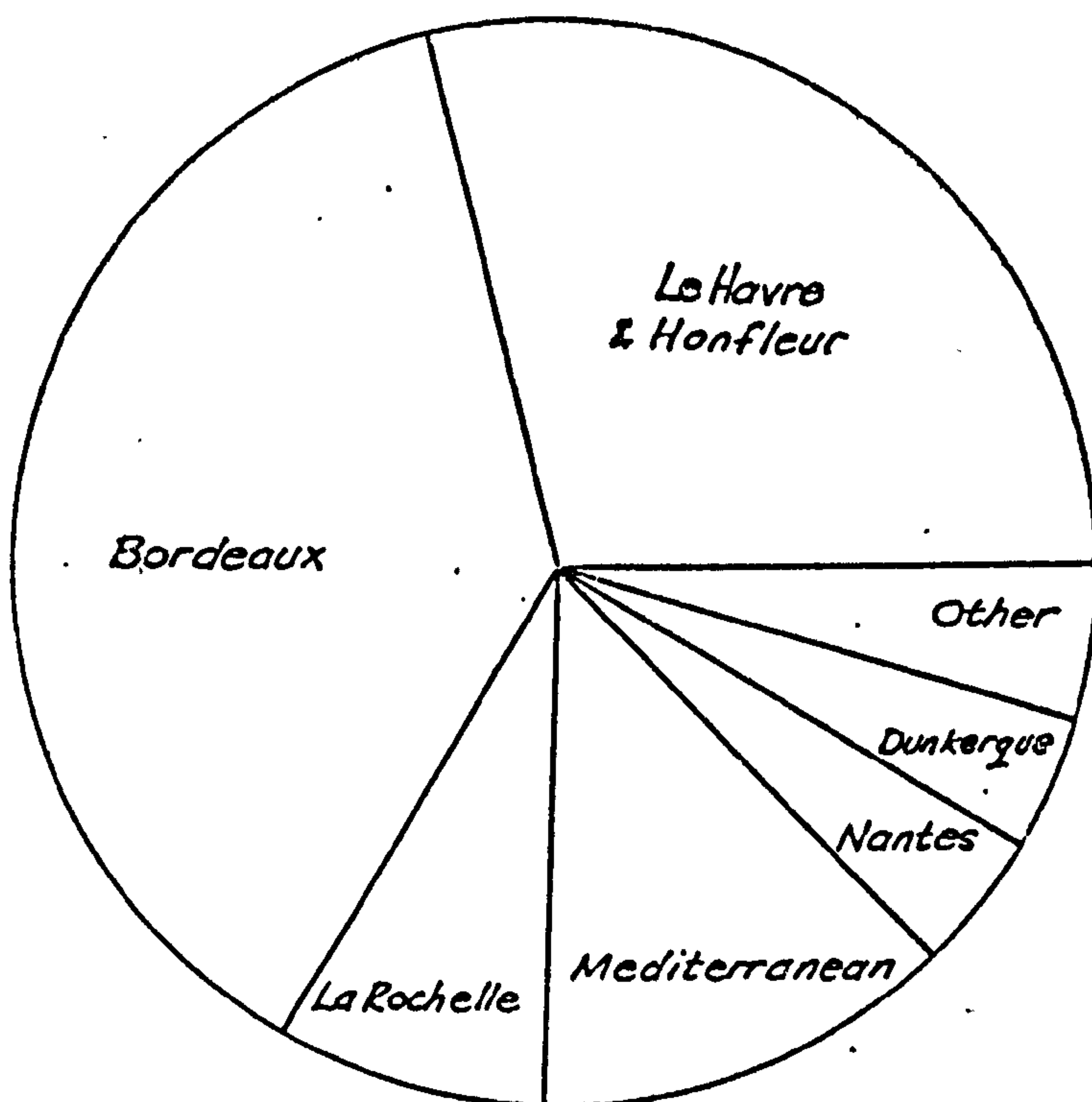
At the western end of the Seine, the intermediaries in this trade to and from Paris, stood the rival ports of Rouen and LeHavre. Since the middle of the previous century these ports had become increasingly specialized. With ships continually increasing in size, the rapidly growing and lucrative trade with the colonies and with the Americas had gone to LeHavre.³ Beyond LeHavre the Seine had always been "assez difficile",⁴ permitting only the much smaller ships engaged in the domestic and European coasting trades to venture up to Rouen. The resulting roles for these ports were succinctly summarized by Stéphane Flachet, a contemporary engineer and publicist.⁵ LeHavre, he said,

...fait la navigation de long cours, achète les denrées et matières exotiques, soit à son compte, soit au compte des maisons de Paris, et revend à Paris, comme négociant, ou comme commissionnaire. Là, se borne la nature de ses opérations, car ce port est presque entièrement étranger au commerce du bassin de la Seine avec les autres ports de la France.

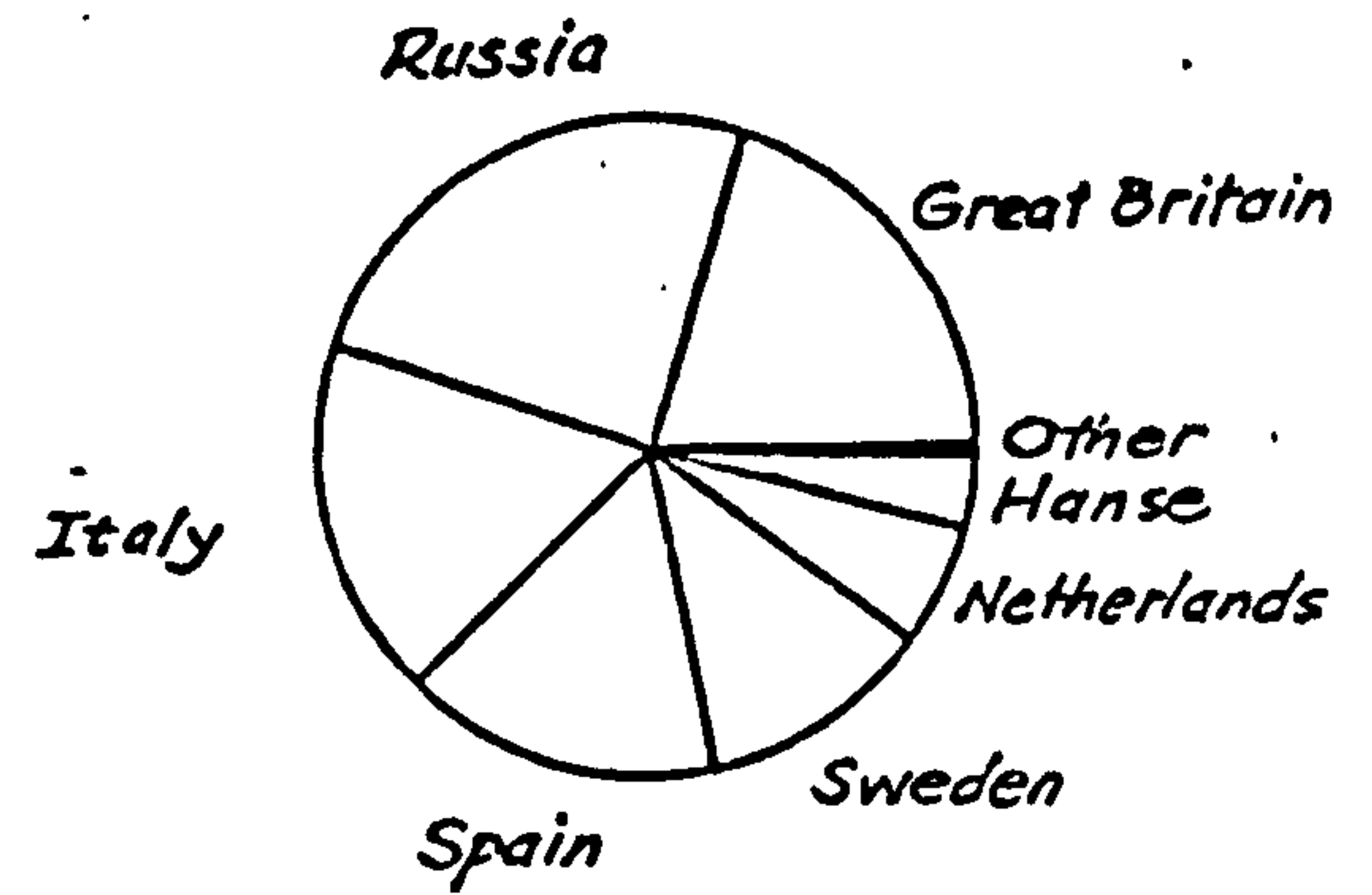
Rouen, on the other hand,

...s'est à peu près retiré du commerce de long cours; mais il reçoit presque exclusivement le grand et le petit cabotage, c'est-à-dire les navires venant des ports d'Europe et des ports Français, pour approvisionner Paris et le bassin de la Seine. Rouen est, purement et simplement, commissionnaire entre les ports d'Europe et de France, et Paris. Il reçoit les marchandises, en soigne le déchargement et le rechargement, soit sur les voitures, soit sur les bateaux qui remontent jusqu'à Paris....

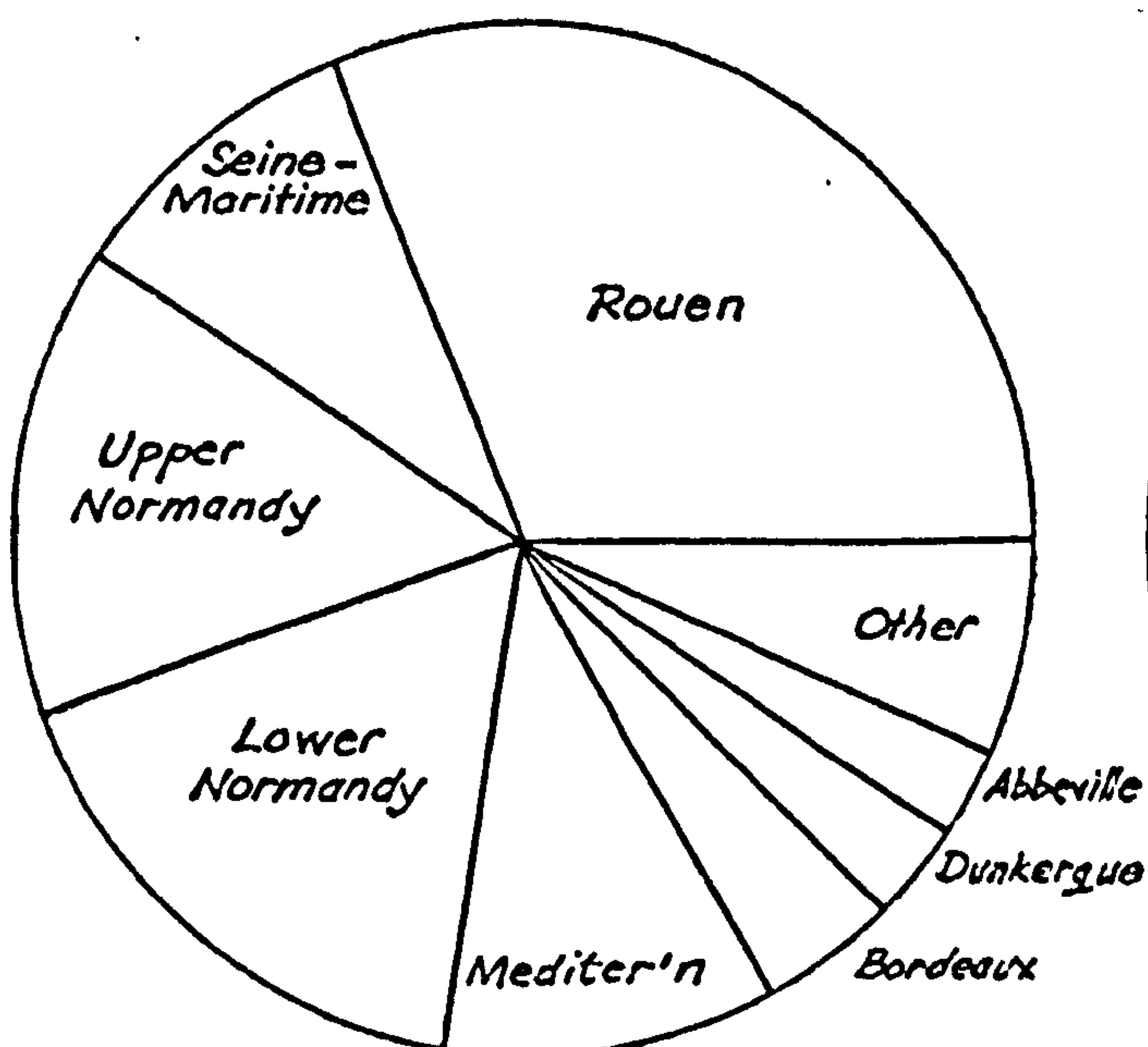
Very closely rivalled by Bordeaux and Nantes, LeHavre was the country's most important port of entry for colonial goods, and it far surpassed any other port except Marseille in its trade in foreign cargoes. Rouen was one of the country's most active coasting ports. Their relative importance in these trades is clear in Figure 2; the sources of their trade in 1824 can be seen in Figures 3 and 4. (Considerable detail on the coasting and



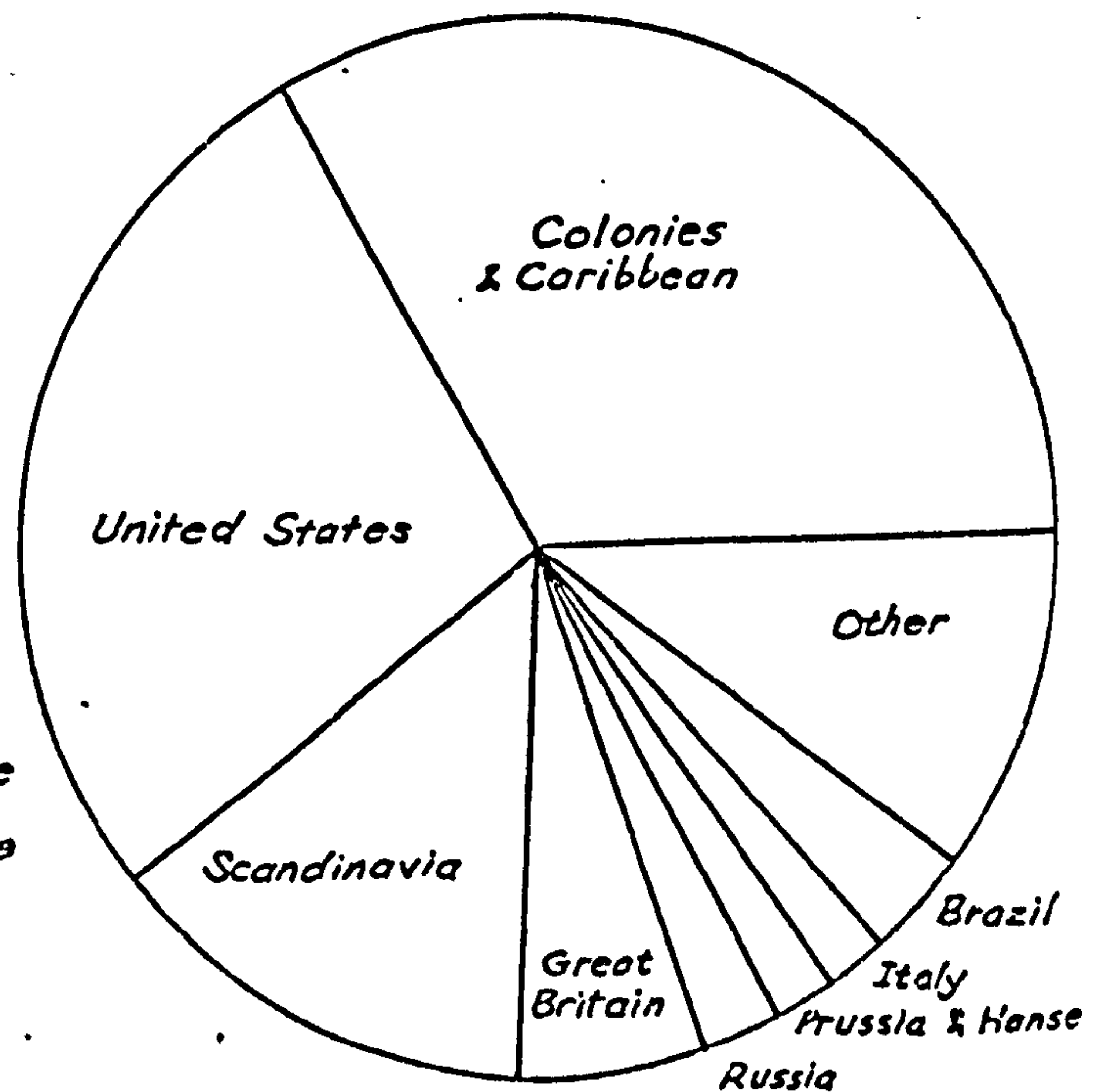
COASTING TRADE



FOREIGN TRADE

FIGURE 3: ROUEN, SEABORNE TRANSPORT
1824

COASTING TRADE



FOREIGN TRADE

FIGURE 4: LE HAVRE, SEABORNE TRANSPORT
1824

foreign trades of LeHavre and Rouen, both origins and destinations and the commodities handled, are given in Appendixes I and II.)

Traditional Water-borne Transport.

Though it carried most of the traffic up to Paris, the lower Seine remained a very imperfect means of transport. It was, and is, divided into two very distinct sections, the "Basse Seine" between Paris and Rouen, and the "Seine-Maritime" between Rouen and LeHavre.⁶ Bridges at Rouen formed the division between the two sections, and Rouen was the point of departure for river boats to Paris.

Navigation on the Seine-Maritime. The Seine-Maritime in its natural state was a useful and heavily used maritime waterway. However, though quite deep in most places, many soft shifting sand banks, a few more solid reefs, and a regular tidal wave created often unavoidable dangers. Although the mouth of the Seine was shallow in comparison with other major estuaries like the Escaut or the Elbe,⁷ it was not a serious obstacle to shipping. It was fairly easily navigated on a good tide,⁸ though several days or weeks could sometimes be spent in waiting for one. Real danger began only at Quillebeuf. Here one encountered the Banc de Tôt, fixed but changeable in size,⁹ and between Quillebeuf and Tancarville there were violent cross-currents strong enough to push a steamboat off its course.¹⁰ Nothing indicated the "tracé sinueux de la route à suivre", said a late nineteenth century president of the Chambre of Commerce in Rouen, "et le pilote n'a pour se guider que la connaissance des amers de la côte: clochers, maisons, bouquets d'arbres sur les falaises."¹¹ Even at this point the river was still very wide, 2,700 metres just below Quillebeuf,¹² and the waters spread out very thinly over this great width; huge banks of sand were continuously, almost daily, shifting position. For ships proceeding up to Rouen it was usually necessary to stop here at the little port of Quillebeuf, and wait for the next good tide. With a pilot on board vessels then set out to cross the most dangerous section of the Seine-Maritime, between Aizier and Villequier. This was the so-called "Traverse", a long

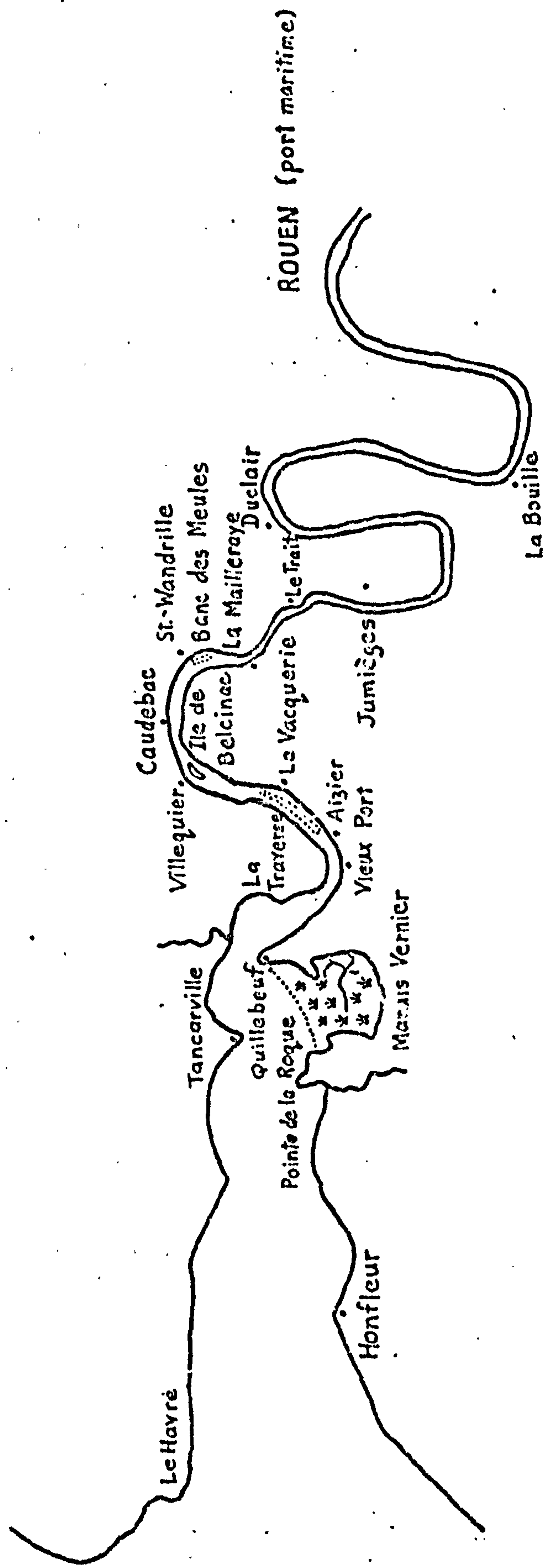
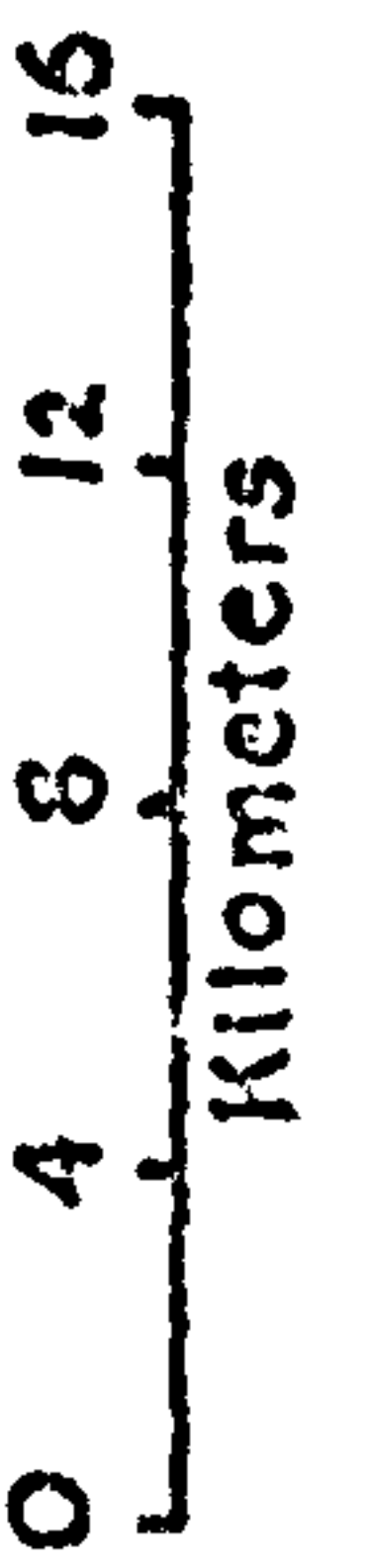


FIGURE 5

LA SEINE-MARITIME



shifting bank of sand beginning close to the right bank at Aizier and gradually widening to fill almost the entire width of the river toward Villequier. The depth here at the highest tide was 3m.30 on the shallowest part of the Traverse, but at low water it was only 0m.40.¹³ Much of this bank was composed of soft sand washed out of small natural indentations in the shore, called "trous" or "anses".¹⁴ The Traverse and most of the other banks in the Seine were formed by soft debris being broken away from the shores of the river by the violent action of the tide and currents; the trous assisted in this by setting up eddies and lateral currents. Leaving the Traverse, the pilot then had to find his way past the Banc de la Barre opposite Villequier, the Chaussée du Caudebecqué, the formidable Banc des Meules, and finally the Banc du Trait. From a little above LaMailleraie the river was narrow and deep. However, it was still very winding, and owing to this, sailing ships had to be towed by horses; some smaller ships were propelled only by the upward flowing tide.¹⁵ Voyage times from LeHavre to Rouen were on average about eight days, but not infrequently rose to three weeks or a month.

In many places the tow paths were in very poor condition. There were fences to climb over or around, flooding was a perennial problem, and sometimes the path became so narrow as to force the horses to wade in the edge of the river. The anses made continuous towing very difficult, and contributed to making frequent crossings of the river necessary. Between Val de Leu and LaMailleraie, said Pierre Frissard, a Ponts et Chaussées engineer assigned to the study of improving the Seine-Maritime,¹⁶

il n'y a pas de chemin de halage; le halage se fait à travers des prairies, les vergers, les plantations sur la crête des murs de soutènement, dans le fond des anses; les hommes et les chevaux courent de grands dangers.

Most dangerous of all to shipping was the notorious "barre" (translated by the English "bore"), a tidal wave of great speed and force, often a metre or more high.¹⁷ Any ship wishing to sail up to Rouen had to time its departure from LeHavre and arrival at Quillebeuf to avoid being caught in the river when it arrived. Beginning at Berville, it surged up the bay, attaining its greatest force in the narrows at Quillebeuf; ships had to be securely anchored at Quillebeuf if they were not to be carried along by it and cast on to a sand bank. Any

ship in such difficulty was almost certainly buried in up to four metres of sand within 24 hours. Between 1829 and 1843, according to a publication of the Chambre of Commerce in Rouen,¹⁸ 48 ships were lost from this and other causes between Tancarville and Villequier; since during all this time tugboats were available in the Seine-Maritime, it is likely there were many more in the earlier 1820s.

Owing to these dangers few ships larger than about 120 tons (the average was about 60 tons, compared with almost 200 tons for those coming to LeHavre) ventured into the Seine. Those ships used simply in the coasting trade need not concern us here. As for the ones used entirely between LeHavre and Rouen, most were simple lighters or "allèges", often referred to locally as "heux" or "houx". Though of many shapes and rigged in many ways, they were all small vessels of 60 to 100 tons and one to two metres draught. Constructed to be "de la plus grande solidité"¹⁹ in order to resist damage both from ice and from grounding in the Seine and in the avant-port of LeHavre, they had internal members on a scale sufficient for ships of 300 tons. There were about 100 of these vessels in operation in the early 1820s according to Charles Bérigny, a Ponts et Chaussées engineer, compared with about 85 in 1789, and only four in 1811.²⁰ Owing to high risks and to high operating costs, operating these allèges had very seldom been profitable. To reduce the impact of both physical risks and financial losses, they were most often owned by groups of armateurs and négociants of LeHavre and Rouen, who formed companies in which each member held a share of one-eighth, one-sixteenth, or even one-thirty-second.²¹

Inland Navigation on the Basse Seine. Above the old Pont des Bateaux in Rouen, only shallow-draught boats could proceed. Maritime navigation therefore ended at Rouen, and all goods coming from LeHavre or any other port had to be transferred to river boats to continue upstream to Paris. The extra costs this imposed upon shippers were considerable. Shipping rates from LeHavre to Rouen averaged about 12F per ton. Unloading, storage and reloading at Rouen were estimated on average to cost about 3F per ton, almost ten per cent of the total cost of

transport from LeHavre to Paris.²² Furthermore, goods were exposed to damage and to theft on the quays. "Les règlements du port", pointed out a tugboat operator in the late 1820s,²³

prescivent, pour éviter l'encombrement, que les bateaux restent au dessus du pont de Rouen, et n'entrent pas dans la partie de la rivière où stationnent les navires de cabotage. Il faut donc que les marchandises soient déchargées du navire sur le quai où il est amaré, puis soient transportées de là sur le quai où stationnent les bateaux, et y soient chargées; les quais de Rouen n'étant point bordés de magasins, les marchandises y restent exposées aux intempéries de l'atmosphère....

During the eighteenth century there had been several unsuccessful attempts to eliminate the need for trans-shipment,²⁴ and the project for a maritime canal during the 1820s was intended by the same means to obtain this result. Legal requirements also stood in the way, for customs regulations permitted neither direct voyages nor direct trans-shipment of most goods. In 1818 a prominent group of Paris négociants petitioned the Conseil-général des manufactures to aid in establishing direct navigation to Paris with ocean-going ships, but although the Conseil welcomed the idea, it decided that the règlements de Douane requiring inspection of all goods at Rouen (the head of maritime navigation) would make this impossible.²⁵

The obstacles to navigation above Rouen were even more numerous than those below. First there was sheer distance. From Rouen to Paris by the Seine was 240 kilometres; by road it was only 126 kilometres. Second there were the many shallows, rapids, bridges and weirs. The Basse Seine was divided roughly into thirteen relatively easy sections or "râcles", with depths never less than two metres, and fourteen difficult sections, or "trémates", with depths of as little as 0m.70. These trémates contained rapids and shallows and were often accompanied by bridges with narrow arches. Beyond Rouen there were eleven other bridges to pass through on the way to Paris; the Pont de l'Arche, probably the worst among them, had been built in the year 960 and was not replaced until 1858.²⁶ At the Pont de Vernon the river was further obstructed by fishnets.²⁷ Here too the tow-paths were mostly in poor condition; they were too narrow, too low and subject to flooding, and they crossed from shore to shore forty to sixty times depending upon the water level. During

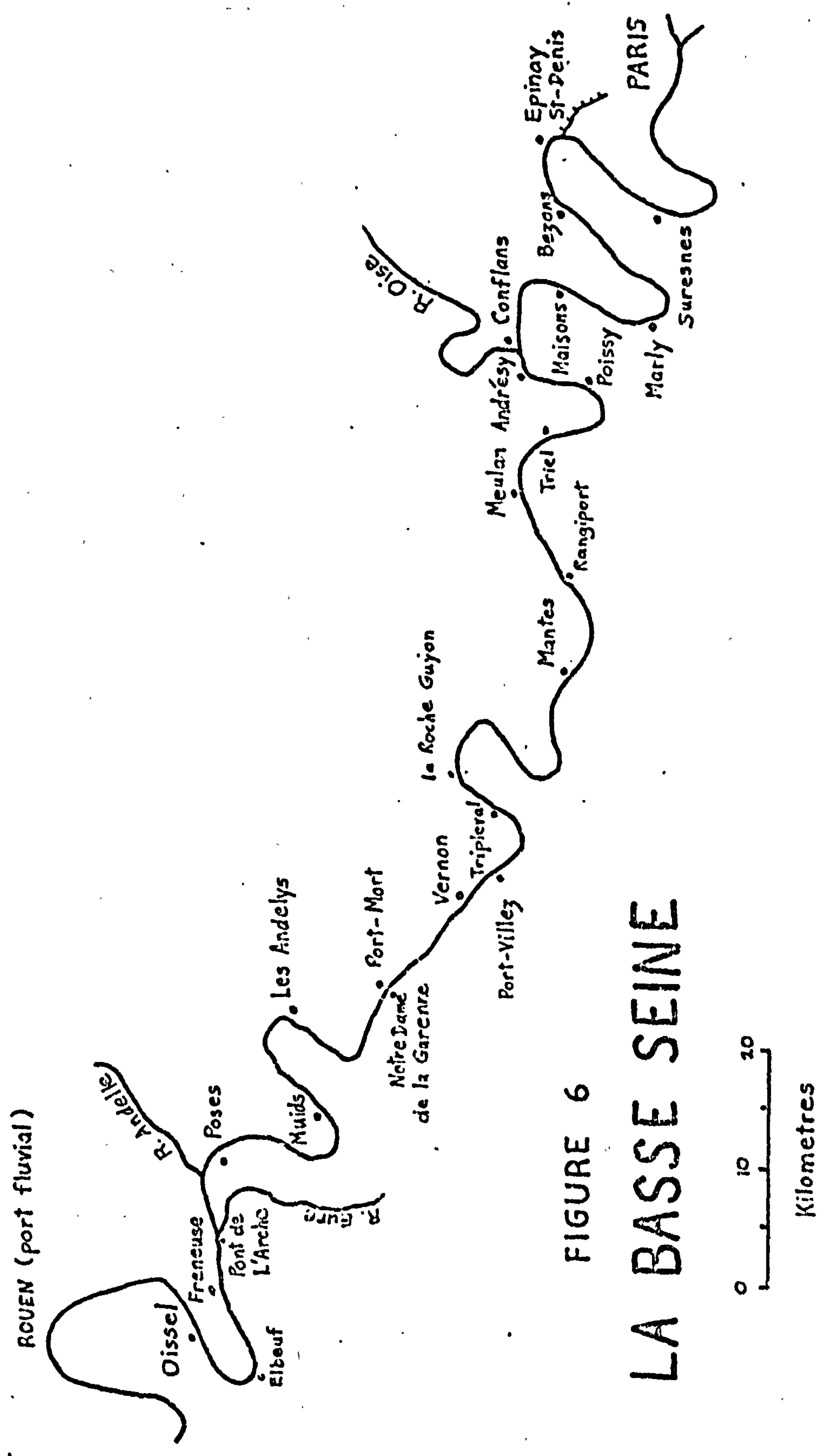


FIGURE 6
LA BASSE SEINE

four or five months of the year water levels were much too low for boats to carry full loads, and in winter and spring when the water was high there was sometimes trouble with ice.²⁸

Seasonal variations in water levels seem to have had considerable effect upon freight rates; this was to be expected, as the cost of carrying one ton of freight would rise as fewer tons were carried. Charles Collignon, a Ponts et Chaussées engineer who did considerable research on transport costs in the 1840s, provides some interesting figures to confirm this.²⁹ He found that as the height of water in the Seine measured by the scale at Vernon varied from 1m.00 to 1m.60, the following water borne transport costs per ton were observed:

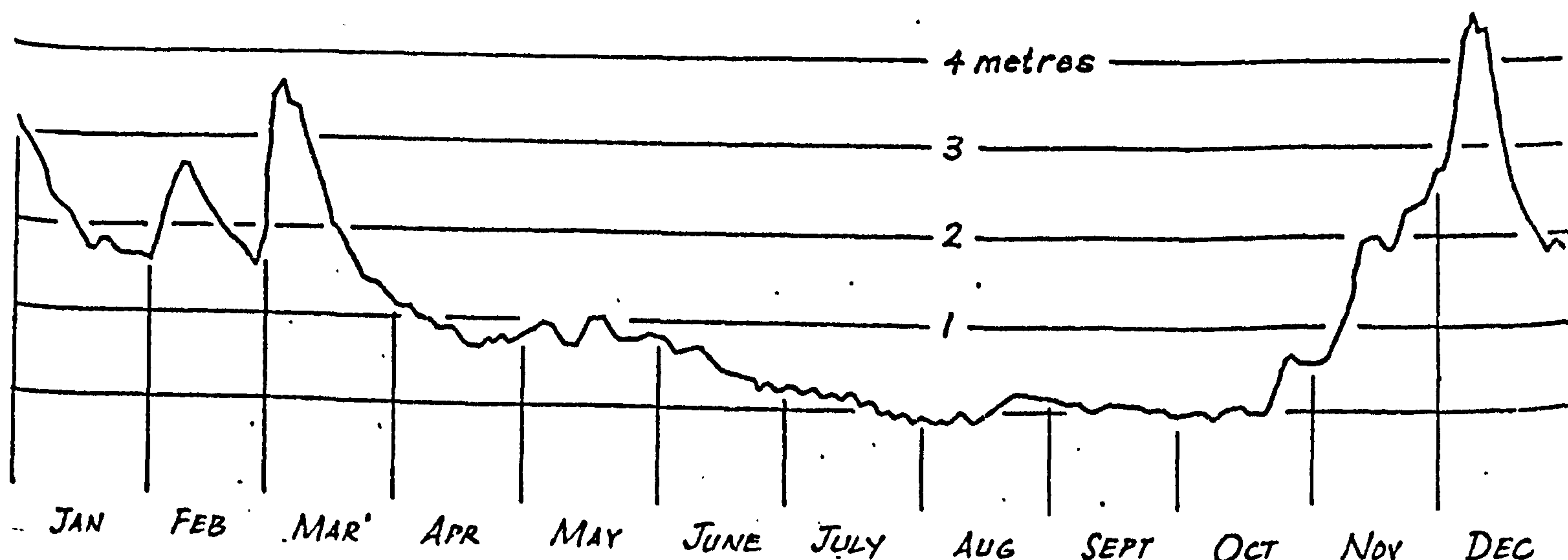
1m.60	7F.70	1m.20	10F.50
1m.50	8F.10	1m.10	11F.50
1m.40	8F.90	1m.05	12F.50
1m.30	9F.50	1m.00	14F.00

The variation was considerable, and costs evidently rose more rapidly as lower water levels were reached. One can conclude that the wider the variation, the higher was the average rate over the year. Seasonal variations tended on average therefore, to push transport costs up. That variations in water levels were quite wide is clearly shown in Figure 7.

Figure 7

Daily Variation in Water Levels on
the Basse Seine, 1825.

(measure at the Pont de la Tournelle)



The total costs resulting from transport were increased by very long journey times. With the methods used during the ancien régime and in the early 1820s boats took anywhere from ten to forty days to make the trip, and the average time was about fifteen days; a further twelve or so were needed to discharge in Paris. On the return journey the time taken was less, an average perhaps of nine days.³⁰ Boats were pulled by the same team of horses all the way from Rouen to Paris, and did only a few kilometres each day; a réglement of the seventeenth century compelled all navigation to cease at sunset. Along the way time was wasted in a number of ways. First, the bateliers were forced to wait at bridges and rapids while each boat slowly made its difficult passage. The passage of rapids and bridges was not only time-consuming, but at times also dangerous. Some idea of the great difficulties involved can be gained from the account of two Ponts et Chaussées engineers who made the trip in 1829 and 1830.³¹ They were in a medium-sized boat of about 1m.30 draft, somewhat less than normal, pulled by eight horses. At the town of Poses they had their first major trouble:

On commence (at 3.30 am) à préparer les manoeuvres pour remonter le pertuis. Seize aides portent un cordage de pieu en pieu sur les îles pour empêcher le bateau d'être emporté par un courant étroit et rapide, tandis que douze chevaux, six à droite et six à gauche le halent. Au milieu de l'île d'amont de droite les six chevaux de droite sont envoyés à gauche dans un bateau et les douze chevaux tirent ensemble, tandis que les aides assistés d'une foule d'habitants de Pose empêchent les cordages de s'engager dans les pièces désassemblées d'un revêtement en charpente dégradé. (At 6.05 am) On arrive au bras d'Anet que huit chevaux passe à gué (avec un peu plus d'eau, il faut un bateau); ils font les plus violents efforts (un cordage est cassé) pour faire remonter le bateau contre le courant rapide qu'un gravier saillant éloigné de l'île; à 6h.½ ce courant est remonté; le passage du pertuis proprement dit est terminé. On paie le chef du pertuis qui part avec ses aides. On fait passer (at 6.38 am) en bateau les huit chevaux de l'île du Trait dans celle de la Ronde, puis à 7h05 de cette île à la rive gauche où les quatorze chevaux tirent à la fois. (Then about 2 km further on, at) bras de Pampon, bordé aux basses eaux de graviers et des falaises saillantes, le bateau touche plusieurs fois; on évite avec peine une pierre dangereuse, cachée sous l'eau. (At 10.25 am) les quatorze chevaux sont remplacés par sept.

It had taken six hours to go a distance of about four kilometres, and this was not the only such passage.

These difficulties had caused loud complaints during the eighteenth century. More than one author stated that it had become so difficult and costly that many merchants preferred to use the road, despite its very high rates.³² One of their chief complaints though had been removed by the Restoration. This was the burden of péages, or tolls. The péages on a fully loaded grand bateau between Rouen and Paris could be as high as 792 Livres plus other fees,³³ and collecting them at many places along the Seine was very time-consuming. Although progressively transferred in large numbers away from private hands to the fermiers-généraux, the péages had not been finally abolished until 1790.

Despite a considerable increase in traffic on the Seine, the methods and types of boats in use had not changed since the previous century. There were several types of boats in use, although one type tended to predominate. They are most readily classifiable by size, and can be grouped roughly into two main categories. The larger of these comprised the grosse marine. The largest boat in use in this period was the bateau-besogne or foncet, of up to 64 metres long, nine metres wide and 2m.10 in draught. By the end of the decade they had probably gone out of use, as they were much too large to navigate easily, and could not use the canals opened through Paris in the early 1820s.³⁴ The most numerous kind of boat used was a type of open barge called a bateau normand or bateau-besogne. They seem to have varied considerably in size, from 32 to 48 metres in length, 4m.70 to 7m.50 in beam, and 1m.20 to 1m.80 in draught.³⁵ An official document of 1834³⁶ gives two types in common use, one of 48 metres by 26 pieds 11 pouces, with a capacity of 480 tons, and the other of 38 metres by 22 to 23 pieds, with a capacity of 250 tons. These boats were the same size approximately as those in use on the canals of the Nord and Picardie, but very much larger than those used in most other parts of France. Large bateaux normands were by far the most commonly used boats for carrying goods from Rouen to Paris; according to the Statistique of Paris, they comprised 89 per cent of the boats arriving in Paris from the Basse Seine in 1821.³⁷ For shorter journeys on the Seine between the smaller ports, like Vernon, Pont de l'Arche, Poses, Gaillon and Les Andelys, a greater variety of smaller boats

were in use; these were loosely called the petite marine. Bateaux normands were often accompanied by two kinds of auxiliary craft, flettes, long and narrow, 21 by 2 metres, and 60 to 80 tons capacity, to act as lighters at shallows and rapids, and bachots, which ferried horses from shore to shore.³⁸ As far as can be determined, these boats were owned by individual maitres mariniers, in much the same way as the auto-moteurs and péniches are owned now by patron-batelliers. Some of them may have been owned by manufacturers who principally carried their own goods. There is one documented example of this from the 1840s and 1850s, the CHARLES a large bateau normand of 490 tons owned by Jean-Baptiste Danton, a small filateur at Oissel.³⁹

Road Transport in the Seine Valley.

While water-borne transport remained in its primitive state in the early 1820s, road transport had been steadily improving both in speed and in economy. Road transport was not so exclusively important in the Seine valley as in most other parts of France, but nevertheless they carried a sizeable proportion of the traffic between LeHavre and Paris, about 25 per cent in the 1820s. The main road along the Seine from LeHavre through Rouen to Paris was the Route Royale 14. From Rouen to Paris, where it was called the route d'en haut (the less-used Route Royale 13 was called the route d'en bas), it had existed for some time, though like most roads, in rudimentary form until early in the eighteenth century. A road from Paris to Rouen and Dieppe is listed in Estienne's Guide des Chemins de France of 1552.⁴⁰ Although a road from Rouen to LeHavre is shown in a "Carte des postes" of 1632,⁴¹ it was not until more than one-hundred years later that it was improved. Early in the eighteenth century road traffic over the plateaux to LeHavre was slight; what traffic there was, and LeHavre was not an important port at that time, went by the river. Then as trade with the colonies grew and the volume of costly goods grew, the need for better road transport made itself felt. Whereas during the Regency there were only four or five wagons a month coming to LeHavre, by 1778 there were over forty. The good road from Paris to Rouen was extended to LeHavre in 1766.⁴²

By the 1820s this road from Paris to LeHavre was not in good condition, and continued to suffer as well from natural disadvantages. During the 1790s and the later years of the Empire maintenance of roads in France had been neglected. In 1811, out of the 8,000 leagues of road in France, there were only 2,900 in good condition; by 1815 this had been reduced to 2,500, and many bridges were destroyed by the retreating armies.⁴³ Heavy winter rains in 1816 did further damage.⁴⁴ In the first years of the Restoration the funds allocated to the Administration des Ponts et Chaussées were far from adequate for anything more than light maintenance, and it was not until the late 1820s that any real progress seems to have been made. Information on the condition of particular roads is not plentiful, but there is one very valuable source, the Statistique des routes royales de France, published in 1824 and 1837.⁴⁵ On the condition of Route Royale 14 in about 1820, it states, "sur cette route les pavages sont partout à relever à bout. Les chaussées d'empierrement ont perdu leur bombement et leur épaisseur. Il y a des terrassements considérable à exécuter." Unofficially opinions were more strongly expressed; the road from Paris to LeHavre, wrote the editor of the Journal de Havre in 1827,⁴⁶ "est sur une grande partie de sa longueur dans un état aussi déplorable que les autres routes de France...." For commerce this meant "des retards dans la réception des marchandises, des spéculations manquées, la vie des voyageurs exposée à chaque instant...." And he concluded, somewhat cuttingly, "les plaintes sont unanimes, elles trouvent des échos partout, et nos voisins d'outremer ne nous épargnent pas les sarcasmes. Il faut avouer que nous les méritons...."

The 126 kilometres between Rouen and Paris were divided almost equally between stone-paved roadway (pavés) and gravelled surface (empierrement), the former beginning at the town of Magny in the Seine-et-Oise. Between Rouen and LeHavre the entire distance of 86 kilometres was gravel, except through the centres of towns. Of the 113.8 kilometres scheduled through the Seine-Inférieure, only 2 kilometres of pavement were considered officially to be in good condition; 21.6 kilometres of pavement needed large repairs or complete rebuilding, and 90.2 kilometres of gravelled surface needed large repairs. In the Eure the situation was a little better; most of the pavement, totalling

only 5 kilometres was in good condition, but only 6.3 out of 31.1 kilometres of gravel were. In the Seine-et-Oise almost the whole distance was paved, and 47.2 out of 55.8 kilometres was in good repair. In the Seine the pavés were also in fairly good condition.

This condition of "état d'entretien" implied only that large overhaul was not needed. In the words of the Statistique of 1824,

si elles sont pavés (they will need) des relevées à bout périodiques, et de simples repiquages; si elles sont en empierrement, le travail journalier des cantonniers stationnaires, aidés à certains époques par des ouvriers auxiliaires, et des fournitures régulières de matériaux proportionnés à l'importance de la circulation....

Even good roads required considerable effort and expense to maintain their viability. The soil and climate along much of the route made maintenance difficult. The effects of rain could be very destructive on the chaulky Normandy plateaux where good foundations and drainage were not easily obtained. With any more than a thin layer of mud, ruts began to form, and the going became very heavy. Jules Burat, a publicist, economist and expert writer on transport in the 1830s gave a graphic description of this phenomenon.⁴⁷ It was rare, he said, to find any tolerably well maintained road with real ruts during the dry summer months. But

il n'est pas de même en hiver. Quand viennent les pluies, les frayes se forment; presque immédiatement après commencent les ornières. Il n'y en a que deux sur les routes peu fréquentées, mais sur les routes que le sont davantage, il s'en forme quatre, six, et jusqu'à huit.... Si on n'apporte pas les plus grands soins à l'entretenir, elle n'offre plus qu'une série de sillons qui se rejoignent dans plusieurs endroits, et qui creusent des espèces de marés; les eaux ne trouvent pas d'écoulement; les chevaux pietinent dans la boue, et dépensent inutilement une partie de leur force;...

That this phenomenon occurred to some extent on Route Royale 14 is confirmed by the average loads pulled per horse recorded monthly in 1825 and 1826:⁴⁸

Jan. (1825)	725 kg.	May	803 kg.	Sept.	917 kg.
Feb.	689	June	847	Oct.	848
Mar.	657	July	836	Nov.	713
April	835	Aug.	877	Dec.	704

The smaller loads indicated in the five winter months, November to March, result partly, says the source of these figures, from the smaller permitted maximum gross weight (5,000 kilogrammes in winter compared with 6,000 kilogrammes in summer) and partly from a poorer road surface. If one assumes if the road surface were the same in winter and summer, for a reduced gross weight in winter fewer horses would be used, and approximately the same load would be pulled by each as in summer, then one must conclude, as this was not so, that the road surface was not as good, and each horse was capable of pulling less. An added natural disadvantage for traffic along this road were the steep hills; going out of Rouen to LeHavre, the Mont-Riboudet hill had a gradient of 8 per cent, and toward Paris there were gradients of 10 and 13 per cent.⁴⁹

Better maintenance and considerable repairs were obviously needed on this road, especially in the Seine-Inférieure. During the previous century considerable technical and organizational advances had been made in this field,⁵⁰ though in practice notable deficiencies remained. First, there was too little regular maintenance. A contemporary mémoire⁵¹ estimated that in about 1828 each full-time cantonnier could tour his section of road an average of only once per week, whereas proper maintenance demanded one tour per day. A decree of 16 December 1811 had instituted a system of cantonniers adjudicataires, contractors whose job it was to give full-time attention to a section of road. These contractors also supplied the needed stone, usually insufficiently. In 1816 they were replaced by cantonniers stationnaires,⁵² day-paid workers under the control of a supervisor. In theory maintenance was to be daily, with careful removal of dust and mud as it formed, but in practice, it was performed by spreading a thick layer of gravel and leaving it until the next inspection when it was again raked smooth.⁵³ Proper economical maintenance was a question of employing the right proportions of labour and materials in a systematic way, and over the next two decades much important research into this question was done by Ponts et Chaussées engineers.

Between LeHavre and Paris, one particular type of large, two-wheeled wagon predominated. This was the charette with a wheel rim size (width) of Om.17 and a maximum permitted gross

weight of 5,000 to 6,000 kg. These were huge vehicles, (one of which is shown in Figure 8) 5m.30 long, 3m.50 to 4m. high when loaded, and 2m.60 wide. They were very solidly, even massively, built, weighing a total of 1,500 kg.; the body weighed 500 kg., the axle 150 kg. and the huge iron-banded wheels 850 kg. together, almost a ton. They were usually pulled by a team of eight horses harnessed in "flèche" formation, one behind the other, bringing the total length of the wagon and its team to almost 25 metres. In 1825, out of 5,267 wagons leaving LeHavre, only 142 were four-wheeled; the rest were these two-wheeled charettes, with an average gross weight of 5,055 kg.⁵⁴

It was argued that the legislated maximum winter and summer gross weights of these vehicles made them the most economical to run: they had the highest proportion of useful to total weight.⁵⁵ Since 1806 road vehicle load regulations had specified the maximum weights to be carried by vehicles with certain wheel rim widths. It was believed that if a larger load were carried on a proportionally wider rim, the effective pressure exerted on the road surface would be the same.⁵⁶ All vehicles were first divided into two classes, "chariots" with four wheels, and "charettes" with two. These classes were then divided into five categories, each of which was given a maximum summer and winter gross vehicle weight. As the solidity of construction of different size vehicles varied, the "useful" or net weight also varied. It was highest for charettes and chariots in the class with rim widths of 0m.17.

Traditionally road transport, or roulage, was organized in a way analogous to that described on the river. Individual voituriers or rouliers owned wagons and horses; in many places these were nothing more than local peasants putting their horses to good use in the off-season. However, by 1820 on the well-travelled Seine route there were very few of these; the wagons needed were beyond the means of casual operators. The services of individual rouliers were hired by commissionnaires de roulage who received goods for transport and took responsibility for their safe delivery. The commissionnaires owned warehouses and stored goods consigned to them until there was sufficient for a wagon-load on any route; then they were sent on their way. They had contacts with many correspondents and could send goods to

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Figure 8: Two-Wheeled 'Charettes' (Vehicles most commonly Used in Road Transport from LeHavre to Paris).

(From Schwilgué, "Mémoire sur les routes et sur le roulage", Annales des Ponts et Chaussées, (1832.2) Plate.)

destinations not directly served by their own rouliers. With this system, the speed of transport had remained roughly the same since the 1770s, about eight days between LeHavre and Paris. According to a mémoire prepared in the Ponts et Chaussées, it had fallen a little behind the national average in this respect. The cost however, had fallen very considerably, from about 90 F per ton in 1770-75 to 35 F in 1827.⁵⁷

Even before 1815 these traditional methods had begun to be superceded by a better form of organization, roulage accéléré. This provided much greater speed and regularity than the traditional roulage ordinaire, and was undoubtedly the most important innovation in road transport for many decades. Wagons operating accéléré were owned by the commissionnaires and departed at scheduled times, travelling both night and day on fixed schedules. Instead of being pulled by the same team of horses throughout the whole journey, they used relays spaced along the route in stages (there were five from Rouen to Paris) and driven by hired drivers. Both garçon-relayeurs and horses were hired on monthly contracts from maître-relayeurs.⁵⁸ The speed and regularity provided by roulage accéléré however, had to be paid for. More horses were needed to keep up a constant speed. First, extra horses were used on the steeper hills, two extra over a distance of about 30 km, and one extra over several more. Relay horses doing the same route, back and forth each day worked less efficiently than ordinary horses which rested at the end of each trip. At 3.5 kph, a normal speed, the work efficiency of relay horses was found to be about ninety per cent of that of ordinary horses.⁵⁹ Owing to more intensive use of the wagons (an average of 64 kilometres per day between Rouen and Paris, compared with only 24 kilometres for roulage ordinaire); depreciation was much quicker; the wheels of voitures accélérées lasted only ten months, the body only two and a half years, while those of an ordinaire lasted two years and six years.⁶⁰ For a large wagon with rims of Om.17, the replacement cost was considerable: for the wheels 615 F, for the axle 288 F, the body 140 F, and accessories 157 F, a total of 1,200 F. The annual costs of depreciation, interest and maintenance of a voiture ordinaire were 530 F; for a voiture accélérée, they were 1,200 F. However, owing to greater speed, and more intensive use, the difference in cost per kilometre was less than this might suggest: about 1F.02 per league (4 kilometres)

Table 1Commodities in Transport Through the Lower Seine Valley, 1824.

I. From Rouen to Paris, except as indicated (tons):

	<u>By River</u>	<u>By Road</u>
Bois de construction	1,600	
Sel	12,846	
Bois de teinture	600	
Marbres et pierres (from Bouen, the Oise and quarries on the Basse Seine)	9,345	
Fers et fontes	2,465	
Bois d'ébénisterie	1,036	1,500
Riz (LeHavre to Paris)	950	
Savons	9,674	
Plomb	3,900	
Zinc et étain	850	
Sucre (Rouen to Paris)	13,884	
Sucre (LeHavre & Rouen to Paris)		14,000
Potasse	3,032	
Soude, sel de soude et salpêtre	4,000	
Soufre	1,200	
Autres produits chimiques	478	400
Tabac (LeHavre & Rouen to Paris)	2,268	413
Harengs et morues	1,000	
Pêches		180
Huile d'olive	935	1,500
Autres huiles	150	10
Fruits et grains oléagineux	120	
Eaux-de-vie et esprits	9,199	
Café (LeHavre & Rouen to Paris)		7,768
Cuivre	1,625	2,400
Coton (LeHavre to Paris)		10,000
Autres matières exotiques		2,286
Autres denrées coloniales		1,887
Peaux bruts (LeHavre & Rouen to Paris) ...		1,000
Vins	65,153	
Cotonnades		4,000
Poterie	240	
Machines (LeHavre & Rouen to Paris)	208	
Draps (Louviers & Elbeuf to Paris)		3,000
Papier	1,000	
Autres	2,078	15
TOTAL	149,836	50,359

II. From Paris to Rouen, except as indicated (tons):

Engrais	1,700
Charbon de bois	4,500
Charbon de terre (Paris to Rouen)	21,695
Charbon de terre (Paris to towns in the valley)	16,956
Charbon de terre (Oise to Rouen)	10,031
Charbon de terre (Oise to towns in the valley)	8,349
Plâtre (Lafrette, Vaux, Triel, Argenteuil to Rouen and environs)	64,000
Plâtre (to towns in the valley)	25,000

/continued

Table 1 continued

II. From Paris to Rouen, continued:	<u>By River</u>	<u>By Road</u>
Ardoises (Paris to Rouen & the valley) ..	9,167	
Briques et tuiles (Paris to Rouen & towns in the valley)	9,700	
Carreaux de meules et meules (Paris to Rouen, Oise & towns in the valley) ...	20,651	
Bois à brûler (Oise to Rouen & valley) ..	20,000	
Bois à brûler (Vernon, Lyon & Pont de l'Arche to Rouen)	19,000	
Céréales	30,000	
Fers et fontes	4,138	4,500
Fers et fontes (Paris to towns in the valley & to towns beyond Rouen by the roads of upper Normandy)		11,000
Tabac indigène (Paris to LeHavre)		630
Vins (Paris to Rouen & towns in valley) .	6,300	
Cuivre laminé		1,000
Antimoine	50	
Regrets d'orfevre	273	
Laines (Paris to Rouen, Elbeuf & Louviers		3,000
Graisses (Paris to LeHavre & Rouen)	360	
Colle et nerfs	1,200	
Sang de boeuf	1,200	
Garance		150
Noix de galle		9
Gaudes		100
Chiffons	300	300
Chardons cardières		100
Acide sulfurique	250	
Salpêtre raffiné	476	
Sulfate de fer (Paris & Oise to Rouen) ..	990	
Acetate de fer et de plomb	15	
Céruse	183	
Encre à écrire (Paris to LeHavre)		148
Couleurs fines (Paris to LeHavre)		59
Eaux de senteur (Paris to LeHavre)		234
Epices préparées		36
Médicaments (Paris to Rouen & LeHavre) ..		44
Poterie (Paris & Oise to LeHavre & Rouen)	756	
Porcelaine (Paris to LeHavre)		116
Miroirs (Paris to LeHavre)		39
Verreries (Paris to Rouen & LeHavre)		463
Librairie (Paris to Rouen & LeHavre)		179
Papier (Paris to Rouen & LeHavre)		200
Papiers peints (Paris to Rouen & LeHavre)		252
Peaux (Paris to Rouen & LeHavre)		221
Cordonnerie (Paris to LeHavre)		196
Pelleteries (Paris to LeHavre)		19
Chapeaux de paille (Paris to LeHavre) ...		20
Meubles (Paris to LeHavre)		758
Instruments et horlogerie (to LeHavre) ..		1,106
Boissellerie (Paris to LeHavre)		190
Machines (Paris to LeHavre)		101
Tabletterie et mercerie (to LeHavre)		337
Feutre (Paris to LeHavre)		31
TOTAL	292,549	25,538

per ton for roulage ordinaire, and 1F.50 for accéléré. For this extra 47 per cent in direct costs, the added speed was 100 per cent.

By the mid-1820s roulage accéléré was well-established on the road from LeHavre to Paris. From Rouen to Paris there had been an accéléré service at least since 1806, serving textile manufacturers who rushed their finished goods to the Paris wholesalers to obtain the best prices on buying days. Once foreign trade resumed in large volume after 1815, this service was extended to LeHavre. Philippe Barrey states⁶¹ that the first was in 1818 by a commissionnaire named Durand. However, there is evidence of another operating to LeHavre from Paris in 1817.⁶² In 1818 a commissionnaire who had operated for many years from Rouen to Paris, extended his operations to LeHavre: Veuve Auffant fils aîné et Lecoq, "désirant, de plus en plus procurer aux Commerçans la promptitude dans les transports," they said in a printed circular,⁶³ set up an office next to the port and guaranteed delivery in Paris in three days. Delivery in Paris by accéléré from Rouen, they said, was still guaranteed in thirty hours. This was half the usual time, and it was not significantly improved upon during the next two decades.

Road and Water-borne Transport in Competition.

Most goods transported between LeHavre and Paris went by water. This is evident from the few statistics available, which are given in Table 1. Although water-borne transport was very slow, it was also much less costly than road transport, and any goods for which speed was not imperative naturally went by water. However, for the many costly goods shipped from the Americas and the Caribbean to the entrepôts of LeHavre (cotton, sugar, tobacco, dyestuffs, coffee), a few goods going to Rouen (especially non-ferrous metals), or manufactured there, and the manufactures of Paris shipped out for export, time was important. For this reason these goods often went by road. The cost of time was beginning to be appreciated, and businessmen tended to conduct their affairs to minimize it. "Le temps", remarked the writer of the Statistique des Routes Royales in 1824,⁶⁴

est une valeur qu'on apprécie mieux aujourd'hui qu'on ne le faisait autrefois: il entre dans tous les calculs des spéculateurs, qui le regardent avec raison comme un des

principaux éléments de la production et de la distribution des richesses; et on le sait très bien qu'une perte de temps équivaut à une perte d'argent.

River transport was quite suitable for many goods such as wood, coal, raw salt, stone, and many bulky foodstuffs, raw materials and semi-manufactured goods. Large quantities of firewood were used in Paris and in the main centres of population along the lower Seine. Timber for construction was also important during the building boom between 1815 and 1825. Considerable amounts were received in LeHavre (20,900 tons in 1824) and in Rouen, mostly from Russia, and 1,600 tons went on to Paris, all by water. Its value was only about 40F per ton in LeHavre, and it could be stored in the warehouses of Bercy for only 70 centimes a ton per month.⁶⁵ The industries of Paris, textiles, metallurgical, chemical and others, also received many of their raw materials by water. One of the most important water-borne commodities was wine. Enormous quantities of it arrived each year in Paris, 214,131,000 litres in 1824.⁶⁶ About one-quarter of this came by river from Rouen, then through the Canals de St.-Denis and St.-Martin to the entrepôts of Paris. A number of factors determined its use of water transport. First perhaps was tradition, and the entrepôts used to store it were adapted to receiving goods from the water; near Rouen there were huge cellars at Dieppedalle where wines were stored after their arrival direct from the Gironde, and in Paris there were large entrepôts at Bercy, St.-Bernard, Neuilly and Courbevoie, which held a stock of some 80 million litres.⁶⁷ Slow transport added about 12F to its value of 300F in Rouen.⁶⁸ However, by road from Rouen to Paris the direct cost of transport would have been about 40F, whereas by water it was only about 15F. Including the costs of time, the difference is still about 17F. The advantage usually held by road transport of not having to transship at Rouen, which would have further reduced the difference by 5 to 10F, was absent, since wines were almost all landed at Rouen in any case.

For many goods however, road transport was preferred. A good example was coffee, valued at about 860F per ton. Large quantities of it were imported from Haiti, South America and the French Caribbean islands, and stored in the entrepôt at LeHavre. From there much of it went to Paris, almost all of

it by road. For 1824, one source lists 7,768 tons by road,⁶⁹ while another list 733 tons arriving by water.⁷⁰ Consumption in and around Paris was about 5,000 tons;⁷¹ and the remainder went on to Switzerland and south Germany "in transit". The time factor seems to have been decisive in making it follow the road in preference to the river. There were many other goods which did the same. Sugar is another notable example; half of the 20,000 tons sent to the 25 refineries of Paris in 1824 went by road. Almost all denrées coloniales and matières exotiques went this way. Manufactured goods almost all went by road, as did cotton goods from Rouen, woolens from Elbeuf, and a wide range of articles de Paris.

Road traffic between LeHavre and Paris was considered officially to be excessive. The slowness and difficulty of navigation on the Basse Seine was forcing far too many goods to use road transport. Not only did this mean high direct transport costs, but it resulted in higher road maintenance costs. The vicious circle created both for users and for the Administration is clearly stated in the following extract from a Ponts et Chaussées mémoire of 1828:⁷²

dès lors à moins que le chemin par terre ne soit impraticable il est préféré, et ... aussitôt qu'on le répare, la Navigation est abandonnée; on en a un exemple récent sur la route du Havre à Rouen qui borde la Seine dans toute sa longueur. Elle était il y a quelques années, dans un tel état de délabrement que des plaintes s'élevèrent de toutes parts, des sommes considérables furent consacrées à sa réparation et aussitôt qu'il fut en état, le roulage quadrupla sur la route aux dépens de la navigation et vint rendre nulles après peu de temps les sommes énormes qu'on avait dépensées sur cette route.

The total of over 75,000 tons carried by road in 1824 represented about 19,000 heavy wagon loads during the year. Maintenance costs were increased it was thought by the use of very large and heavy vehicles. Schwilgué, a Ponts et Chaussées engineer, suggested⁷³ that they could be reduced by half between Rouen and Paris if maximum permitted loads were reduced by one-quarter.

It was very clearly recognized that the total, direct and indirect, costs of transport could be reduced by a better distribution of traffic between road and river. That the Administration des Ponts et Chaussées understood this is evident in the excellent introduction to the Statistique des Routes Royales of 1824. It was understood, it stated, that certain classes of

goods naturally found road transport more economical. Economic advance had increased the value of time, and

dans l'état présent de la société, il est un grand nombre de besoins et de services publics et privés qui ne se trouveraient qu'incomplètement satisfaits par la voie régulière mais nécessairement un peu lente, de la Navigation.

Under freely competitive conditions, the calculation of cost would be the ultimate criterion of choice, "et l'on conçoit qu'il est bien d'occasions où ce calcul sera nécessairement à l'avantage des communications par terre." The key therefore to moving traffic away from the roads and back onto the waterways was to reduce the cost of transport on the latter. "Les routes cesseraient d'être fatiguées par un roulage destructeur; elles conserveraient toujours un bon état de viabilité, et leur entretien deviendrait moins dispendieux."⁷⁴ It was estimated that if all routes royales could be restored to an état d'entretien, annual maintenance costs could be reduced by almost thirty per cent to about 16.5 MF. The ultimate conclusion, though this report did no more than imply it, was that the key to more economical transport was improvement of the waterways and of the craft which used them.

CHAPTER TWO

The Maritime Canal, Revival of an Old Idea

It was obvious that transport in the Seine valley ought to be improved. Even before the Revolution, the rapid growth of colonial and overseas trade through LeHavre and Rouen had prompted several schemes to improve navigation on the Seine. In the early years of the Restoration not only was there a strong revival of trade, which once more pointed out the need for better transport, but there was also the very successful example of similar improvements made in England. Better inland transport could come about in two ways, from innovations affecting the vehicles of transport, and from innovations to the 'way'. The first was quite within the power of the private operators of transport, but it would mean successful adaptation of very recent inventions, principally steam power. The second would depend largely upon initiative from the Ponts et Chaussées, but for some years after 1815, while the State's resources were overwhelmed by the burdens of foreign occupation and a huge indemnity, any such initiative was quite impossible. Nevertheless by 1820 both possible avenues of improvement were opened. Relative prosperity had returned to the economy, permitting private entrepreneurs to invest in costly new steam power, and by the same date not only had the national Treasury recovered a delicate sort of equilibrium,¹ but the government had also appointed an energetic new Directeur-général des Ponts et Chaussées, its chief agent in planning and executing transport investments. Why then by the end of this decade had the Ponts et Chaussées made so little progress in improving the 'way' while the private operators of transport had had such great success in improving their vehicles? The answer to this is interesting, for the resulting delay in a successful initiative by the State to improve water-borne transport had effects which were to last for several decades.

Disagreement Over Means for Improving the Lower Seine.

Interest in water-borne transport and in its improvement were very high in the early decades of the nineteenth century.

During most of the eighteenth century the waterways had been largely neglected while attention was concentrated upon improving the roads. Even in the last years of the Old Regime, though there had been a revival of interest in the waterways, little real progress had been made in the few years before the Revolution. By 1789 there were about one thousand kilometres of canals in France (most of them built in the previous century), and an equal length of navigable rivers. About 200 kilometres of canals were completed during the Empire.² Louis Becquey, the newly appointed Directeur-général des Ponts et Chaussées,³ took as his first task to revive the declining momentum of the programmes begun by former regimes, and gave particular attention to the needs of water-borne transport. In 1820, less than three years after taking office, he presented to the government a comprehensive report on the nation's waterways,⁴ both summarizing their existing situation and proposing measures to improve and extend them. It attempted to set down the outlines of a complete national system of waterways, and though it was certainly a very ambitious plan, it seems to have been widely accepted. Important and concrete results came from it almost immediately. Following recommendations contained in the Report of 1820, loans were negotiated with a number of financial syndicates (later sanctioned by law in 1821 and 1822), in order to finance construction of improvements on fifteen waterways. Considerable work had already been done on some of the waterways involved, at a cost of almost 53 MF, and it was estimated that the additional cost of completing these and about 2,000 kilometres of new waterways would be over 126 MF.⁵ At the same time as work was begun on these, technical studies were begun by engineers of the Ponts et Chaussées on other waterways in the national system, including the lower Seine.

With few exceptions, all of the improvements undertaken in the programme of 1821 and 1822 involved artificial waterways, that is canals. Though the Report of 1820 explicitly recognized the obvious need also to improve the country's many good natural waterways, there was nevertheless a strong inclination by contemporary experts to favour entirely artificial means for doing this. In many parts of the country of course construction of artificial canals was unavoidable if any kind of navigable waterways were to be created. In other places

however, as on the lower Seine, navigable waterways already existed which merely needed to be improved. Amongst the techniques available for doing this there was a clear alternative, either to 'canalize' the river channel itself, or to build a parallel, or so-called lateral canal. Existing theory and experience indicated that lateral canals were the better solution. It was Joseph Dutens, reputed to be one of the principal authors of the Report of 1820 and ingénieur-en-chef in the department of the Nièvre, who later wrote the authoritative Histoire de la navigation intérieure (1829), in which he stated the classic arguments for canals, derived principally from British experience. Engineers had not, he said, been able to devise a good technique for canalizing rivers, and those who had sought to combine canalization with sections of lateral canal had usually finished by building an entire lateral canal. "On connaît ce mot," he wrote,⁶

si souvent reproduit de Brindley, à qui au sujet d'un canal qu'il persistait à établir près d'une rivière, on demandait pour quel objet il pensait que la Providence eût créé des rivières: ce fut, répondit Brindley, pour alimenter les canaux. Nous pensons, en effet, qu'il n'y a que des obstacles insurmontables qui doivent empêcher se substituer à la navigation fluviale la navigation en canal....

Experience in canalization of rivers in the eighteenth century had not been successful, and proper techniques had not yet been developed and tested.

Improvement of the lower Seine was an important element in the national plan. One of the principal long lines of communication sketched out in the Report of 1820 was that joining the Mediterranean to the Ocean by way of the Rhône, Saône, the Canal de Bourgogne, the Yonne and the Seine. Completion of the Canal de Bourgogne was one of the projects authorized by the law of 1822. As for the Seine, the Report made the tentative suggestion that a canal be built from Honfleur to Villequier, but left any firm decision until after detailed studies could be completed. A thorough survey of the lower Seine was in fact soon begun by a group of eleven Ponts et Chaussées engineers under the direction of Charles Bérigny, inspecteur-divisionnaire for the Seine basin. From these studies emerged two reports by Bérigny, the first describing a project for canalization of the river, as was being undertaken on the Oise, and the second for a large maritime ship canal from LeHavre to

Paris.⁷ Although canalization was technically the more adventurous of the two, since the methods for doing it were still undeveloped, the project for canalization was the one favoured by Bérigny and his engineers. Pierre Frissard, for example, who studied the section between Villequier and Rouen, recommended a form of canalization, a modification of which was 25 years later applied.⁸ In the Seine-et-Oise the ingénieur-en-chef Antoine Polonceau concluded that the only realistic method of improving the Basse Seine would be canalization; artificial navigation by means of lateral canals or derivations, he wrote, would inevitably prove much too expensive and would run up against the innumerable obstacles of bridges, roads, and established river interests.⁹

Though not recommended by Bérigny, the idea of building a maritime ship canal to Paris and by this means creating a "Paris, port de mer", was very much favoured in Paris during the 1820s. Such a canal would give a depth of six metres, as opposed to only two by canalization. By bringing ocean-going ships all the way up to Paris it was thought that the costs of trans-shipment at Rouen and LeHavre could be avoided and overall transport costs reduced. Moreover it would facilitate the creation of useful and profitable warehouse facilities for overseas goods in Paris. By no means was this a new idea; most of the projects undertaken during the 1820s, including the maritime canal, were based upon ideas and plans developed in the previous century. In 1768 and 1769 a captain Bertholot had made four voyages from LeHavre to Paris with an ocean-going ship of 160 tons; and at about the same time an engineer, Sieur Passement, had designed a canal to bring such ships up to Poissy.¹⁰ A decade later Gouffier proposed a maritime canal from Dieppe to Paris,¹¹ which was recommended to the government by the municipalité of Paris.¹² In 1787 and 1788 Sieur Isnard, ingénieur des ponts et chaussées, proposed another such canal to follow the Seine, Eure, Vêgre, Ivette and Brievre from Rouen to Paris.¹³ Another similar project was put forward in the Year IX by one Lesueur, directeur de la flotille maritime de la Seine, who took it up again in 1816.¹⁴ During the Restoration the idea was revived, and a request was made in 1818 to the Conseil-général des manufactures by a number of Paris merchants for direct sea-going navigation from LeHavre to Paris. The request was rejected

for the time being as impractical, but in 1819 the Minister of the Interior asked that the Council reconsider the matter and advise him how best to establish "navigation directe entre LeHavre et Paris" and a "gare d'eau à Paris."¹⁵

Bérigny believed that for economic reasons a maritime canal could not be justified. The technical problems he was sure could be overcome, but ocean-going ships would find no real advantage in going any farther inland than Rouen. They could not use their sails on a canal and their masts would interfere with bridges; their crews were much larger than needed for a horse-drawn river voyage, and their capacity much too small to compete with large bateaux normands. Shallow-draught river boats, he argued, could carry three to four hundred tons, and with smaller crews and reasonably short voyage times would retain their existing advantages regardless of the cost of trans-shipment at Rouen. The potential benefits from a maritime canal did not therefore seem sufficient to justify the very large costs likely to be incurred, carefully estimated by Bérigny at about 200 MF. The benefits to be obtained from such a project were estimated by comparing existing transport costs with potential future costs. The total annual saving if all goods then being trans-shipped at LeHavre and Rouen were taken directly to Paris would have been 2.73 MF over the existing costs of about 6.2 MF. This indicated a rate of return on investment of little more than one per cent per annum, and it would take over seventy years for accumulated savings to equal the original cost of a canal.¹⁶ If, he stated,¹⁷ one were to

se borner à des spéculations basées sur les produits certains que l'on pourrait obtenir dans l'état présent des affaires, il faudrait se restreindre au simple perfectionnement de la navigation actuelle, et rester toujours en lit de rivière.

Despite Bérigny's very clear advice however, it was the maritime canal and not the more modest scheme for canalization of the Seine which was chosen for further study in 1825. There were two main reasons for this unfortunate choice. The criterion of economic feasibility was generally but rather vaguely accepted in the 1820s. It was accepted on two different, though not necessarily conflicting levels. First, all projects it was thought ought to be financially viable, since they would probably be financed by private capital. The Report of 1820 had mentioned the need for "projets bien conçus, bien étudiés,

dont la possibilité est certaine, dont les profits peuvent être calculés et mis en balance avec les frais que des particuliers voudront prendre à leur charge."¹⁸ In practice however, this general advice was only very loosely adhered to. For on a second level, every project was thought to have additional benefits not accruing directly to its owners, but to the economy in general. Any doubts about the immediate profitability of a project could be dismissed by a contemplation of its almost certain immense indirect benefits. The Report spoke of increased land values, rising employment, expanded internal markets and faster growing industry. Great Britain of course was taken as the example of what was possible. But the analogy was much too facile, as C.-J. Minard, a Ponts et Chaussées engineer and economist recalled a couple of decades later.¹⁹ "On a cru", he wrote, "qu'il suffirait d'ouvrir des canaux en France pour obtenir un grand commerce intérieure." Many of the canals built under the programmes of 1821 and 1822 were planned for their development potential, but in fact lay idle and incomplete, and were a gigantic financial failure. This was owing partly to a miscalculation of their costs, but also to an over-estimation of their benefits. Similar exaggerated expectations seem to have been partly responsible for the maritime canal scheme. The enthusiasm of baron Charles Dupin, polytechnicien and publicist offers a good example. "Des navires de fortes dimensions," he wrote,²⁰

pourraient, en évitant les sinuosités et les longueurs du fleuve, arriver avec rapidité jusqu'au pont d'Iéna, dans un vaste port qu'on ouvrirait auprès des Champs-de-Mars. Cette seule entreprise suffirait, peut-être pour changer les destinées commerciales et maritimes de la France. Appelons sur elle l'attention de tous les amis de notre puissance nationale.

The usual argument was that even though there was not at present sufficient commercial activity to make a scheme pay its way, the new activity it would create, added to the old, would do so. This was not necessarily incorrect, but most often this argument was little more than an exaggerated faith in the efficacy of the technically grandiose. It permitted Bérigny's very practical objections to the canal to be passed over.

This kind of naivety was less current within the Ponts et Chaussées than among the general public, and there is ample evidence to show that the Administration des Ponts et Chaussées

was never in favour of the maritime canal. However, it was rendered incapable of executing its own choices by another aspect of contemporary 'doctrine', the belief in the need for private financing. The governments of the Restoration were not willing to invest public funds in large public works projects; they contented themselves with maintenance work and with some improvements to the roads. The same Charles Dupin complained in 1824²¹ that since the end of the wars, "dans la plus grande prospérité de nos finances", the government had been spending only 31 MF each year on public works. Michel Chevalier commented in 1848²² that "le gouvernement de la Restauration paraît avoir été constamment dominé par le desir d'avoir des finances dans un ordre parfait, et il y avait réussi." Perhaps it was too conscious that the Revolution of 1789 had been provoked by a financial crisis. It is also true however, that never during the eighteenth century had the State spent large sums from the Treasury to improve the waterways; funds for this purpose had come to a large degree from private financial sources.²³ The system adopted during the Restoration was merely a reversion to this tradition, encouraged once more by the example of Great Britain. Joseph Dutens had been sent on a mission to study British methods at first hand,²⁴ and the Report of 1820 concluded that

l'expérience a démontré l'efficacité du mode employé par nos voisins dans ces sortes d'affaires: l'administration devra examiner si, en adoptant, au moins en partie, un semblable système, nous ne pourrions pas recueillir les mêmes avantages.

The effects of this system on the lower Seine however, were unfortunate. Because the State was unwilling itself to undertake any large projects, the ultimate decision as to which projects would be undertaken was put into private hands. The Ponts et Chaussées was made incapable of offering any competing alternative. Despite an inclination in the Administration to follow the advice of Bérigny, the maritime canal therefore was allowed to proceed.

The Maritime Canal: its First Stages, from 1824 to 1828.

Sometime in 1824, Charles Dupin tells us,²⁵ just as construction of the canals of 1821 and 1822 was begun, an influential group was formed to study the possibility of building either a lateral ship canal or an improved river navigation on the Seine between LeHavre and Paris. They went almost immediately

to Great Britain, as many had before them, to study the forms of association common there for financing such large projects. The government of Villèle was very favourable to this scheme, partly because it hoped to gain political credit from its expected economic success, and it put every facility at the group's disposal. They were welcomed in London by the Prince de Polignac, the French ambassador, and put in contact with Dupin, who had many knowledgeable and influential friends in England, and who was himself something of an expert on public works in Great Britain. In October 1824, when the association were decided on their course of action, they sent a letter to Polignac²⁶ containing an outline of their plans. They took as their project the old idea of a maritime canal. A company should be formed, they wrote, stock sold to the public, and commercial and technical studies made, after which construction could commence. All the preparatory stages they thought would take about one year. The rates charged by the company would be moderate and give considerable economies over existing transport costs.

The skepticism of the Ponts et Chaussées was revealed almost immediately. The Minister of Finance was asked to grant a concession to the embryo company, and he referred the affair to Becquey for advice. His reply clearly indicated the different direction he thought further studies should follow.²⁷

On conçoit que pour amener les bâtiments de mer jusqu'à Paris il faudra se jeter dans des dépenses énormes, tandis qu'il sera possible à moins de frais circuler de Paris à la Mer, et réciproquement, des bâtiments d'eau douce qui porteront le même tonnage que les navires. Dans le premier cas, il est vrai, il n'y aura ni stationnement sur la côte ni transbordement de marchandises et les spéculateurs qui se présentent aujourd'hui devront examiner si l'économie qu'on assure par là au commerce peut compenser la différence des tarifs plus élevés auxquels il faudra l'assujeter pour couvrir les frais du premier établissement d'un canal qui étendrait la navigation maritime dans l'intérieur des terres au delà des limites que la nature semble lui avoir assignées.

According to a recent study, he continued, a depth of nine feet could be obtained at far less than the immense cost of this canal, and would enable flat-boats of up to 800 tons to enter Paris. However, he recommended that the scheme be allowed to proceed since the organizers of the company seemed to be familiar with their subject. A formal application was made for a "concession" to build and operate the canal, and on 16 February, 1825

an ordinance was published authorizing the company to go ahead with studies.²⁸

The structure of the company then set up was unique and specially adapted to the limited objectives set by the ordinance. It was not a société anonyme, nor did it issue any stock for sale. At the head of the company was sort of 'steering group', the Conseil-directeur, composed of seven eminent personalities. When it met for the first time on the 10th of March 1825 its members were²⁹ the Prince de Polignac and his brother the duc de Polignac, both closely connected with the regime; the baron de Vitrolles, an ultraroyalist and adviser to Charles X; the comte Mollien, a financier and former Minister of Finance of long and varied experience; the comte Beugnot, a Napoleonic prefect and later a liberal deputy from Rouen; Berryer fils, a liberal (though later Legitimist) avocat; and the baron Charles Dupin, already mentioned, who incidently had been Berryer's colleague on the defence at the trial of Marshall Ney. Under this council worked a very small staff headed by Stéphane Flachet. All the plans and calculations of the company were to be submitted to two committees, one of three Ponts et Chaussées engineers, to verify cost estimates and to check technical details, and the other of five négociants and bankers to verify estimates of traffic and to set a tariff.

The financial resources required by the company during the planning stage were not expected to be large, but for construction it would require as much or more than those brought together for all the waterways included in the programme of 1821 and 1822. Financial backing seems to have come from a variety of sources. The principal organizer seems to have been Charles Ardoin, head of the firm of bankers Ardoin et Cie.³⁰ He had been associated with Jacques Laffitte in the Cie des Quatre Canaux of 1822,³¹ and in loans to Germany, Poland and Russia in the early Restoration period,³² and he was involved in property development in Paris. Ardoin was the chief among the five members of the commission des négociants which had had the task of estimating the company's revenues and setting its tariffs; with him on this committee were also Lafond fils, Charles Vital-Roux, a Regent of the Bank of France and head of a bank established with the aid of Jacques Laffitte in 1823, and Larreguy, secretary of the Société commanditaire de l'industrie established in 1826 as the commercial arm of Guérin de Foncin,

another banker.³³ Last among its members was Drouillard, of the firm of Blaque, Drouillard et Certain, also bankers.

The first obstacles encountered by the canal's promoters were technical. The technical problems involved in building such a deep canal along the Seine, beginning with a wide estuary and continuing along the river's very winding course, were very considerable, and nothing on this large scale had ever been attempted before. Detailed surveys of the canal were fairly quickly completed between Rouen and Bezons (about 40 kilometres west of Paris) and submitted to the committee of engineers. In this section it was planned that the canal would have a uniform depth of five and a half metres and it would cross the Seine at seven points by means of partial dams across the river.

In April 1827 the committee's rapporteur Cavenne returned a favourable report and no objections seem to have been raised.³⁴ Next the plans were sent to the Commission des canaux of the Conseil-général des Ponts et Chaussées, and there they did not pass so easily. There it was objected that the canal's relation to the river and its existing traffic had been insufficiently considered; the seven partial dams might seriously interfere with river traffic, steadily growing in the 1820s, and they would be strongly opposed by river transport operators. The rapporteur to the Commission des canaux, Brisson, an old and respected engineer, took up this problem of the seven dams and in a very imaginative report recommended a radical change in the company's plans. He suggested a new route, entirely on the north shore, from Oissel to Paris, which would avoid all crossings of the Seine. He admitted however, that this would greatly increase the canal's cost.³⁵ In the second draft of the company's plans the number of crossings was reduced to four, but the problem of interference with the river was never properly solved.

The seaward section, from Rouen to LeHavre, was far more difficult, particularly in the estuary of the Seine. Techniques for deepening estuaries and controlling the effects of tides were still very primitive and controversial. The first proposal made by the company's engineers on this section, Pattu and Pouettre, both of whom had worked with Bérigny, was for a long dam between LeHavre and Honfleur. It would be built to the height of low-water level, protected by an advance breakwater, and detached from the shore at each end to allow the river to

flow outward and ships to pass inward. Long jetties attached to the north shore would direct the main stream toward Honfleur. It was hoped by these means to slow down the outflow, creating a greater depth behind the dam, and to reduce the destructive effects of the tide and the barre.³⁶ Objections were immediately raised against it. Some said that a dam and breakwater could never withstand the force of sea and tides. The most determined opposition came from A.-E. Lamblardie. His father, J.-E. Lamblardie, had been the well-known and respected engineer in charge at the port of LeHavre at the end of the Old Regime, and it was he who had made the first extensive study of the tides and currents on the Normandy coast and in the Baie de Seine. He had also taken an interest in the problem of improving navigation on the Seine, and had proposed that a canal be built from LeHavre to Villequier on the right shore.³⁷ A similar project by baron Cachin, who was still a member of the Conseil-général des Ponts et Chaussées in the early 1820s had got as far as being examined by the Legislative Assembly in 1792.³⁸ As for the dam proposed by Pattu and Pouettre, A.-E. Lamblardie believed that its effects would be first to block LeHavre's harbour with coastal gravel and later to flood its quays.³⁹ Lamblardie seems to have gathered some support among the Conseil-général, for the company was forced to ask the Minister of Marine to set up a special commission of engineers to study the question,⁴⁰ and although only one of its members, Sganzin, agreed with the objections of Lamblardie,⁴¹ who was his step-son, and wanted to reject the dam entirely, the majority of the commission gave only conditional approval to the plan.⁴² Their conditions were that a study must be made of the tides on the coast of Normandy from Cherbourg to Dieppe to remove any doubts about their effects upon LeHavre, and before any part of the dam was started, a canal must be built through LeHavre from Sainte-Adresse to Ingouville, to provide an alternate route around the dam. At the same time another of the company's engineers, Fresnel, had been continuing surveys of a larger canal from LeHavre to Villequier (the same route recommended by the elder Lamblardie), and in view of the opposition to the dam, the Commission des canaux recommended in its final report in October 1827 that this project be adopted. Though its cost was estimated at about 70 MF, the company reluctantly agreed.⁴³

It was now the spring of 1828. The company had spent three years and 700,000 F on its studies, and they were far from complete.⁴⁴ Perhaps with a view to forcing the pace a little, in February 1828 it sent a partial project to Becquey for his consideration. The Commission des canaux to which the project was sent for examination was not at all satisfied. Not only was the total cost of the project still very uncertain, but the company had apparently still not decided which route it wished to follow above Rouen. In any case the project it had submitted went no farther than Bezons, and there were no plans for the entrepôt in Paris, the commercial heart and raison d'être of the project. The total cost of building the canal and its accessories was estimated by the company at 160 MF; this included 70 MF from LeHavre to Rouen, 66 MF from Rouen to Bezons, and 24 MF from Bezons to Paris, including the entrepôt. These were enormous amounts, which could easily be exceeded, and the Commission wondered whether the advantages of lower transport costs might be more economically obtained by other means.⁴⁵

En d'autres termes faut-il consacrer 200 millions au prestige d'une Navigation Maritime si, par exemple, il suffisait de dépenser 25 millions pour assurer le transport du Havre à Paris, dans un même temps donné, et au même prix, d'un même tonnage de marchandises, à l'aide d'une navigation fluviale de deux metres de tirant d'eau?

Without the continued support of the other governments which followed that of Villèle,⁴⁶ the company was forced as a result of this unfavourable report by the Commission des canaux⁴⁷ to reconsider its entire project.

The company decided to proceed only with the section of the canal between Rouen and Paris. This decision seems to have been prompted not only by opposition to its plans in the Administration des Ponts et Chaussées, but also by the accumulation of risks which threatened the financial success of the project. Stéphane Flachet, one of the company's leading organizers, wrote⁴⁸ that owing to uncertainties about both costs and revenues, the company was forced to reduce its plans to smaller and more predictable proportions. In its original form it would not have been sufficiently attractive to potential investors. Attractiveness would depend on both the probability of an economic rate of return on capital (at that time usually taken to be about six per cent for a risk-free investment), and

an adequate premium for risk. According to its own estimates, the company would offer a return to investors of about ten per cent; the total capital costs would be about 160 MF, and the annual net revenue about 16.5 MF. This rate of ten per cent however, depended upon revenues rising quickly to their full amount after completion of the canal; it also depended upon an uncertain estimate of the canal's ability to compete with existing river transport and an equally uncertain estimate of costs. Transport on the river had been considerably improved in the last two or three years by the introduction of steamers, and by fast chalands pulled by tugboats; journey times as a result had been much reduced. Therefore the canal's ability to compete would have been considerably reduced. More likely to affect the potential investor's confidence were the uncertain cost estimates. This was particularly worrying in 1828, for it was just then becoming evident that the estimated cost of the canals begun in 1821 and 1822 would be far exceeded. In his report on the Situation des Canaux in 1828⁴⁹ the Minister of the Interior had revealed that the latest cost estimates exceeded the original ones by 37 per cent; the costs of land, labour and materials were all rising as demand for them by a growing number of projects increased. The cost of urban land, of which the maritime canal would need a great amount, he said, had become especially high. The consequences of all this for the maritime canal were obvious; the four per cent estimated risk premium offered to its prospective shareholders was far from adequate.

Premature Plans for a Railway.

There were even rumours at this time that the maritime canal scheme would be abandoned in favour of a railway; they were carried in the relatively unimportant Paris newspaper Le Courrier des Chambres in June 1828.⁵⁰ Nothing came of them. A railway had been planned in 1825, but it also had soon been dropped in face of technical and economic uncertainty. Speculative activity in transport had not been confined in 1825 to canals. In that year England had experienced its first very small 'railway boom', though only a few short lines of railway were begun. It had faint echoes in France, but its concrete results there were even smaller. Most interest in railways in France was still at this early stage very local and specific, centred on the coal mines of the upper Loire and their

need for better communications with Lyon and the Rhône valley. As commercial enterprises railways were completely untested and still in a very elementary stage of their development. They were considered suitable only for relatively short routes and for hauling specialized cargos like coal. In 1824 however, this circumscribed role had been exceeded for the first time in the ambitious plans for the Liverpool to Manchester railway. The analogy between this route and that between LeHavre and Paris was an obvious one to contemporary observers, and prompted perhaps by the canal company's application for a concession, two groups of engineers and bankers applied for permission to build railways along the same route. Although neither of these groups was able to take its project beyond the early planning stage, they are both historically interesting for the accuracy with which they pointed to the future.

The first application, about which very little is known, came in early February 1825 from a group of English capitalists, sponsored by an engineer called Isaac Sargent. Sargent seems to have had no previous experience of railways; he was a manufacturer of bricks and tiles in Paris in partnership with a certain Thomas Hodgkin.⁵¹ The group formed to build the railway took the name of Isaac Sargent et Cie, and on 28 April 1825 they obtained a patent for the importation and development of "routes en fer ou en bois, destinées aux transports des marchandises et des voyageurs, à l'aide de voitures d'une construction particulière, mises en mouvement par des machines à vapeur, hydrauliques, ou autres moteurs fixes."⁵² British capitalists and manufacturers had been engaged in France for many decades, but this was their first venture into railways; fifteen years later, the successful Paris to Rouen and LeHavre line retained its place as the first French railway to be financed substantially by British capital.

A few weeks later another application was received from a French group. Much more is known about this company. François Bartholony, later connected with the Paris-to-Orléans Railway, tells us⁵³ that its main source of capital was a number of Paris banking houses, and he listed five of them: a recent addition to the 'haute banque parisienne', C. de Lapanouze, two newcomers to Paris, B. Paccard and Dufour, and two departmental receveurs-généraux, Michel de Saint-Albin and Adrien de la Hante. As Navier, the company's engineer, commented,⁵⁴ these were names

from the "premier rang des maisons de banque de la capital." This too was an important indication of future sources of railway capital; until the 1830s, the small number of railways built were financed by combinations of mining and metallurgical companies and canal interests with a small contribution by local bankers.

Both companies clearly saw the railway as an alternative to the canal or to any other improvement of the river. "L'établissement d'un chemin de fer entre Paris et Rouen," wrote Navier in 1826,⁵⁵ "présentera au commerce un moyen de transport beaucoup plus prompt, plus sûr et plus économique que tous ceux qui existent aujourd'hui;" and it would conserve "tous ces avantages, et même celui d'économie, quelque soit les travaux fait pour améliorer la navigation de la Seine...." Navier carefully calculated its cost of establishment to be about 31 MF⁵⁶ which was certainly much less than the canal. He thought it would be a more economical alternative to the canal partly because any economies from improvement in water-borne transport would inevitably be cancelled out by an equal rise in navigation dues. In any case, no improvement of the river could provide the faster transport which was undoubtedly "un des principaux besoins du commerce."

Predictably, reactions to these proposals were not unanimously favourable. The plans of both companies were transmitted almost immediately by the Minister of Public Works to the Chambres of Commerce in Paris, Rouen and LeHavre. The Parisians welcomed the idea, but were skeptical that it could overcome inevitable technical and other obstacles. However, they requested the Prefect of the Seine to ask the Directeur-général des Ponts et Chaussées to draft a cahier des charges for the line, and to make a concession to the lowest bidder. To reduce its cost, they recommended that the 30,000 tons of iron rails needed for the line be imported free of duty from Great Britain; the use of imported rails would prevent inflationary pressure on the price of iron in France.⁵⁷ The Chambre of Commerce in LeHavre also responded with enthusiasm, and in LeHavre as well the railway seems for a while to have been seen as a feasible alternative to the canal.⁵⁸ In Rouen however, as was expected, the reaction was entirely hostile. The Chambre of Commerce in Rouen admitted⁵⁹ that it would perhaps effect

considerable savings in transport costs; on a ton of raw sugar for example, it calculated that the present direct transport cost of 4,100 F could be reduced to about 3,100 F and an additional 1,350 F could be saved by shorter transport times and cheaper insurance. However, it was obvious that the operation of such a railway would do irreparable damage to the port of Rouen and its associated transport and other industries. It cited the owners of 1,500 to 2,000 charrettes and the twelve to fifteen thousand horses engaged in roulage, four shipbuilding yards, and one-hundred businesses engaged in maritime commerce.

There are several reasons why this first attempt at a railway failed, though their relative importance is difficult to judge. First, it was technically before its time. When powered by horses a railway had few clear advantages over existing methods of transport, almost all of which also used horsepower. The fundamental limitation of the horse was its lack of speed. Its most efficient speed was reckoned to be somewhere between three and four kilometres per hour⁶⁰ and above this its load-pulling capacity fell quite quickly. This optimum speed of course was the same for all forms of transport, waterways, roads and railways. A horse walking at about four kilometres per hour on a railway could pull only about one-fortieth of the weight it could pull on a canal with still water. Canals could therefore operate more cheaply. At higher speeds, the load-pulling capacity of horses on water and rails became equal (at about twelve kilometres per hour), but at this speed the efficiency of both was considerably reduced, and the cost increased. Where there was an adverse river current, as in upstream travel on the Seine, the advantages of horse-drawn water transport over its equivalent on rails was greatly reduced, but it was still two to one on the lower Seine.⁶¹ Though on the level, a horse-drawn railway had an advantage over an ordinary road surface of about seven to one, this quickly disappeared on any more than the smallest gradient (of which there were many between LeHavre and Paris).⁶² For pulling a large volume of general cargo over long distances therefore, horses were not considered suitable. The directors of the Liverpool and Manchester Railway; the first to be built in England specifically for general cargo, were convinced in 1829,

that "pour l'immense mouvement commercial qu'on prévoyait devoir avoir lieu sur le chemin de Liverpool à Manchester, les chevaux étaient hors de la question...."⁶³

Secondly, opposition to the railway was strong, first from Rouen whose whole commercial existence depended to a large degree upon poor inland transport, and from protectionist ironmasters who opposed the essential imports of rails. A remark in the Journal du Havre in 1827⁶⁴ indicated that this was a very important factor in its failure. G. Lefranc has stated much more recently⁶⁵ that the project was rejected by the Administration des Ponts et Chaussées for fear that it would create competition for the maritime canal. However, it seems unlikely that the project ever reached the stage of being actively considered by the Ponts et Chaussées; there is no evidence to suggest that it did. The most effective and immediate reason for failure was probably withdrawal of financial support. There was a serious financial crisis early in 1826 and the speculative bubble burst; it is likely that neither the British company's backers nor the Paris bankers could afford in such circumstances to commit any of their assets to such a long-term and speculative project like a railway. In any case, by 1826 there was less need for a railway owing to the considerable improvements which had been made in river transport.

Revision and Abandonment of the Maritime Canal Project.

The maritime canal company quickly prepared a new and shorter project from Rouen to Paris, and during the thirteen months from its presentation to the government in the Revolution of 1830, most of the stages toward its final approval seem to have been completed. The new project was prepared for the company by M. Bayard de Lavingtrie,⁶⁶ and though all the necessary surveys had not been completed, it was presented for approval on 25 June 1829.⁶⁷ Some of the changes suggested in the previous year were accepted, and the number of river crossings between Oissel and Paris was reduced from seven to four, only three of them needing dams. The width and depth would be made sufficient for ships of up to 200 tons, including steamers, which the company firmly believed would benefit from using the canal.⁶⁸ The total cost, though raised by the greater width

needed by steamers, was reduced in this new project from 90 MF (for the Rouen to Paris section of the original larger project) to 64 MF. Although the Conseil-général des Ponts et Chaussées had several reservations and suggested other less costly methods for improving the Seine,⁶⁹ the project was submitted unaltered by the Directeur-général to public inquiries in January 1830.

The Company's purposes in building its canal were unchanged despite its great reduction in size. They were still to eliminate trans-shipment at Rouen, and to centralise both the control and the actual processes of French maritime trade in Paris. It was still expected that shipping rates direct to Paris would be little more than existing ones to Rouen. The company did not believe that Rouen would suffer in the long run, because being mainly a manufacturing city, it would benefit from better access to markets and raw materials. Overseas shipping would still be conducted from LeHavre, and with the greater depth provided by the canal, allèges and steamers could easily navigate directly to Paris. An equally important element in the company's plan was a group of warehouses it would build west of Paris on the plain of Gennevilliers, modern "magazins que les navires et les bateaux puissent accoster d'un côté, et des chariots de l'autre...." The port established next to them would replace the several scattered existing ports of Paris, act as a customs warehouse or "dock", and give direct access "à toutes les natures de transports". Transport to the centre of Paris they thought might be provided by a "route à la Stephenson".⁷⁰ Similar so-called "docks-entrepôts" had been operating in London and Liverpool for more than a decade.

Both Rouen and LeHavre were naturally hostile to the project, and they had an opportunity to express their opposition officially during the public inquiry held in January 1830.⁷¹ The reasons for Rouen's hostility are obvious; the Chambre of Commerce objected that the canal would seriously hamper established transport on the Seine, and anyway, it said,⁷²

n'est-il pas étonnant que l'on s'occupe d'un canal pour faire monter les grands navires à Paris, lorsque déjà ils ne peuvent plus arriver à Rouen sans de grands dangers. Avant de travailler dans la haute Seine, ne devrait-on pas chercher à faire disparaître ou à diminuer ces dangers?

LeHavre was more optimistic about its own powers of survival, and its Chambre of Commerce thought the canal would be very

worthwhile, but it was entirely opposed to the idea of a large entrepôt in Paris. It would damage LeHavre's traditional entrepôt business. "La nature elle-même", it suggested,⁷³ was opposed to such a project.

Despite this opposition, negotiations between the company and the Bureau de Commerce for a concession began very soon after the company had submitted a definitive request.⁷⁴ They were not easy, since the company's demands were large. Though the Bureau de Commerce approved the company's tariff schedules, and agreed with its estimate of net revenue, it refused to permit the company to charge any fee to river boats passing through its dams, and limited the company's monopoly of transport on the canal to only twenty-seven years. It stipulated further that only the city of Paris could be given the responsibility for building and operating the entrepôt.⁷⁵ The company reluctantly agreed to these modifications⁷⁶ and seemed optimistic that a concession would soon be granted. Then came the July Revolution and nothing further was heard from the company for fifteen months.

There were several causes for this long silence. Several of the company's most important supporters were closely associated with the deposed regime, and had been compelled to leave Paris, either to exile or prison. Some financial support may also have been withdrawn in the economic crisis which followed the Revolution in 1830 and 1831. Several of its backers were affected. Laffitte's difficulties are well known. Ardoin was forced to declare bankruptcy.⁷⁷ Guérin de Foncin and Vital-Roux were both forced temporarily out of business in 1830.⁷⁸ Many other companies also found it impossible to sell their shares or bonds; the canal companies set up in 1821 and 1822 were especially badly affected. Two departures from the company were especially damaging. In July 1830 resignations came from the two brothers Stéphane and Eugène Flachet, who had directed much of the company's research.⁷⁹ When resuming contact with the Administration des Ponts et Chaussées late in 1831 it was discovered that many of its documents and valuable maps were missing from the official files, and the company had to reconstruct its case without the help of its two main experts.

The new government and administration were not sympathetic to the company's project, which had been actively promoted by some of its predecessors, and the company restarted its negotiations under conditions very different from those of 1829. The advice of the Directeur-général and Conseil-général des Ponts et Chaussées were now given more attention by the government and this did much to retard the company's progress. The engineers on the Conseil-général had never been satisfied with the dams which must be built across the Seine at several points where the canal crossed it. They had recommended in February 1830 that should a concession be granted, each of the company's dams should be approved before being built. After convening a meeting with representatives of the company and his own Ponts et Chaussées officials in November 1831, the comte d'Argout, Minister of Public Works, decided that a thorough study of this question must be made and a definite policy decided before further negotiations could take place.⁸⁰ There had been great progress made in improving transport facilities on the Seine since the company had begun its original studies in 1824, and the Ponts et Chaussées were concerned that it not be diminished or further progress retarded as a result of the maritime canal. One reason for limiting the canal company's monopoly to twenty-seven years had been to lessen the adverse effects such a monopoly would have upon technical progress. In his report on the question of the dams in March 1832 Tarbé de Vauclairs reluctantly recommended that the dams be accepted in principle; the Conseil-général added that the company must be compelled to pay for any additional locks needed when improvement of the river itself took place, and that it must give free passage to all boats if the locks or dams were ever damaged.⁸¹ These were difficult conditions for the company to accept, and negotiations did not continue for much longer. The Conseil-général considered the scheme for the last time in May 1832.

The Maritime Canal Becomes Obsolete. By 1830 there was a lively debate going on amongst engineers as to the technical merits of various means of improving land and water transport.⁸² There had been great skepticism in the Ponts et Chaussées about the wisdom of building a maritime canal when the idea had first been put forward in the mid-1820s, and this was now more widely and articulately expressed. In a post-script to its final recom-

mendations the Conseil-général des Ponts et Chaussées expressed its regret that it had never been permitted to consider any possible alternatives to a maritime canal.⁸³ Several recent studies had shown there were simpler and much less costly methods of improvement which would accommodate flat-bottomed river boats. A memoir describing one of these, by the engineers Coic and Duleau,⁸⁴ had been widely read and was sent in September 1830 to Legrand, secretary of the Conseil-général. These studies reinforced the view that other feasible means existed, and although it is evident from a reading of the procès-verbaux of the Conseil-général that there was no agreement on the relative merits of various methods, it was accepted that one could be found which would be technically sound and offer benefits at least equal to those from a maritime canal, and at a far lower cost. Whether a project were financed by private or public means, remarked a member of the Conseil-général,⁸⁵ it would use up scarce capital resources. The Conseil-général therefore should recommend the project which promised the greatest benefit for the least estimated cost. This principle, an early hint of present-day benefit-cost analyses, had been more explicitly stated by C.-J. Minard in a course drawn up for the Ecole des Ponts et Chaussées in 1831.⁸⁶

By this time the railway had also emerged as an alternative to the maritime canal. It is clear moreover that the establishment of the railway as a practical means of long-distance general transport was a decisive factor in the collapse of the canal project. The railway projects put forward in 1825 had failed owing partly to their dependance upon horses for motive power, but in 1830 with the development of the locomotive as a viable source of power, this dependance was abruptly ended. While there were many who still predicted that the future role of railways would be limited to carrying passengers and the few goods then carried by messageries, after this date their relative superiority over such costly alternatives as the maritime canal was well established.

There is little doubt that the locomotive's sudden emergence as a viable source of power made a clear impression upon interested observers in France. The development of railway technology was closely followed in France by several eminent engineers, and a few of them added their own innovations, some

of the greatest importance. The first locomotives appeared in France in 1829, after the Compagnie du chemin de fer de St.-Etienne à Lyon ordered two of the most advanced types from the factory of Robert Stephenson at Newcastle.⁸⁷ One of them was sent to the factory of Hallette at Arras, the other to Marc Séguin in Lyon, both to be used as models for construction of other locomotives.⁸⁸ After tests however, it was discovered that the average speed of these machines was no more than six kilometres per hour, hardly better than horses. Most engineers in both Great Britain and France remained unconvinced that locomotives would soon become a satisfactory source of power for railways. In 1829 when the directors of the Liverpool to Manchester railway were trying to decide what form of motive power to use on their line, they commissioned two eminent engineers, Walker and Rastrick, to investigate the relative merits of fixed and locomotive engines, by then thought to be the only alternatives. These two men, in a lengthy report later published in France,⁸⁹ concluded that fixed engines were preferable; although locomotives would require less initial capital investment, the annual expense of operating them and therefore the cost of transport, would be greater. One of the main reasons for higher annual costs was the supposed damage their great weight would cause to the track.⁹⁰ Only on the insistence of Robert Stephenson, the company's engineer, did the directors decide that a contest should be held to encourage engineers to perfect the locomotive and prove its superiority over fixed engines; it was this challenge which resulted in the famous Rainhill trials of October 1829, and the subsequent revolution in the technique and economics of railway operation.

The change of opinion which occurred in France after the Rainhill trials is very clearly shown in a publication of 1830.⁹¹ In 1828 two engineers, L. Coste and A.A. Perdonnet, travelled to England and Scotland to look at the most recent developments in railway technology. Using the data of Walker and Rastrick, the latest generally available, they could only conclude in their report that between fixed engines and locomotives there was no clear choice. However, after the Rainhill trials they were compelled to add a new conclusion. "Ce mémoire", they wrote;⁹²

imprimé en grande partie avant que nous ayons eu
connaissance à Paris des résultats extraordinaires auxquels

a conduits le concours de Liverpool, renferme nécessairement plusieurs conclusions ou opinions, qui, basées sur des observations que nous avons faites l'année dernière en Angleterre, demanderaient aujourd'hui à être modifiées. Les expériences (of Rainhill) semblent promettre aux chemins de fer un brillant avenir. Il paraît incontestable que les nouvelles machines locomotives, unissant la force à la légèreté, à l'économie et à d'autres qualités moins importantes, sont infiniment supérieures aux anciennes.

This same conclusion was drawn by all; "depuis cette époque," wrote an English author in 1830, translated into French in 1831,⁹³ "la question entre les machines locomotives et les machines stationnaires doit être regardée comme jugée par l'expérience." Another French author confirmed that it was "la solution complète du problème de l'application de la force de la vapeur à la locomotion sur les chemins de fer."⁹⁴ The "Rocket" which caused such excitement at Rainhill used a multi-tubular boiler, an invention first successfully developed by Marc Séguin and patented in 1828.⁹⁵ By this means Stephenson succeeded in greatly reducing the weight of the locomotive required to generate a given horsepower. Compared with all previous locomotives its performance was quite remarkable. Its own weight was only four and a half tons, yet it averaged more than twelve miles per hour (nineteen kilometres per hour), and at times did better than twenty miles per hour, pulling loads of twenty tons.⁹⁶ Its power was equal to that of its immediate predecessor the "Lancashire Witch", which had twice its weight. Moreover it seemed to give a considerable economy in fuel consumption.⁹⁷ The "Rocket" was quickly improved upon by Stephenson, and the model he sent to France for the St.-Etienne-to-Roanne railway and put into service in July 1832 (it was the first in France) could pull a load of sixty tons at twenty kilometres per hour.⁹⁸

With such performance from railways using locomotives, their ability to compete with horse-drawn transport, as was planned on the maritime canal, seemed to be quite definitely established. Stéphane Flachet wrote in 1832 at about the time the maritime canal was being discussed for the last time in the Conseil-général des Ponts et Chaussées,⁹⁹ that he believed a railway had become the best means of providing economical and fast transport along the Seine. In October 1831 when the company was restarting its project, Bérard, the new Directeur-général des Ponts et Chaussées, expressed the view that the canal

could no longer expect to compete against a railway.¹⁰⁰ A railway had been studied again and several companies had proposed to build one along the Seine; the results of any competition between it and a canal were indicated, he said, by the "grand nombre de chemins de fer qui en Angleterre longent des canaux et leur font une concurrence ruineuse."

Applications to build short sections of line from Paris toward the sea had been made by two companies in 1831, and on 15 October 1831 (two weeks before Bérard's letter quoted above) the administration had decided to award a concession to Mellet, Henry, Ruolz et Cie, for a line to Pontoise, with an option for its extension to LeHavre and Dieppe.¹⁰¹ Although this concession was later revoked by the Conseil d'Etat, the feasibility of the project seemed to have been broadly established. An arrêté of the Prefect of the Seine-Inférieure on 15 July 1832 set up a commission of engineers to produce an avant-projet for a Paris-to-Rouen railway. They estimated the total cost of 122 kilometres of line at only 14.5 MF.¹⁰² It would carry goods at ten to twelve kilometres per hour and passengers at twenty-five to thirty; this meant goods could go from Rouen to Paris in only seven to eight hours. Its rates, it was hoped, could be set at averages of 24F.40 for Rouen to Paris and 18F.30 for Paris to Rouen. It was apparent that the maritime canal could never compete with the railway's speed, and if the railway took about one-fifth of the total water-borne traffic, as the commission estimated it would, the canal's revenues would suffer very seriously. Although some of those involved in the canal company stubbornly clung to their project,¹⁰³ much of their financial support seems to have been transferred to railways.¹⁰⁴ It is clear that the canal company's career was at an end.

CHAPTER THREE

Successful Innovation in River-Borne Transport

The maritime canal failed to materialize because it was too ambitious and too costly, and because it was a technical anachronism. Before the difficult problems associated with its planning could be solved, it was overtaken by progress in inland transport. Though a railway would not be built for more than a decade, very concrete progress was being made with river transport even by the mid-1820s. The most important technical element in this was steam power, but the crucial factor in successful innovation was its adaptation to the peculiar conditions on the lower Seine. Success went to those with modest ambitions and modest means. Though the earliest experiments were not successful, this was a remarkably inventive decade, and as operating experience was gained, new ideas came forward, modifications were made, new combinations were tried and permanently viable innovations evolved. It was not until the early 1850s that they were superseded.

The Simplest Solution, Freight-Carrying Steamers.

To provide greater speed and regularity, the steamboat was the obvious choice of means. For some years however, the efforts of several companies to establish steamers on the lower Seine from LeHavre to Paris brought at best only limited success, and more often complete failure. Steamers of course were not a new invention, and primitive craft had been demonstrated on the Seine by Robert Fulton during the Consulate.¹ Since then they had been operating successfully and profitably in Great Britain and North America. The Seine was one of the first waterways on the continent of Europe to make use of steam; the first practical steamer arrived on the Seine to begin a service between Rouen and Elbeuf in 1816. The ELIZE, built entirely in Great Britain, and powered only by a single ten-horsepower engine, continued in service until 1818 when it was forced to retire owing to certain unknown "incidents techniques".² The first unsuccessful attempts at steam navigation were not made on

the Loire or the Rhône until 1822.³

During 1822 and 1823 several steamers belonging to three companies began operating on the lower Seine. The first of these companies had been formed in 1820 and operated four steamers between Rouen and Paris. In the summer of 1819 a mechanic and inventor named Joseph Raymond had obtained a patent for a paddle-driven steamboat, and early in the following year sold it to a company formed in Paris under the management of J.-J. Magendie.⁴ The initiative in forming this company, known both as the Cie Magendie and as the Société Anonyme des Transports Accélérés, probably came from a group of Parisian négociants wanting faster transport from the sea to Paris. Finance capital came from these négociants, one of whom, a certain Bentabole, owned almost half the company's capital of 400,000 F,⁵ and from a number of bankers, lawyers, fonctionnaires, landowners and aristocrats, few with any apparent previous interest in transport on the Seine. The initiative in forming the second company, whose ships operated over the entire distance from LeHavre to Paris, came from Great Britain. British investment in France in this period was very common, and especially in Normandy.⁶ It seems to have originated with the desire to exploit another invention, the iron hull. The principal organizer of this company was Aaron Manby, manager of a Staffordshire coal mine, builder of steam-engines, and an inventor of considerable ability. For a decade he had been managing partner of the Horseley Coal and Iron Co. near Tipton in south Staffordshire, and had used and probably built several iron barges for this business. In 1820, for reasons which are unknown, Manby extended his activities to France, beginning with steamshipping on the Seine. In that year he (or perhaps Daniel Wilson, his future partner in the Charenton iron works in Paris, acquired by them in 1822⁷) induced several others, including Captain Charles Napier, then a resident of Paris, to join in forming a company and to pilot its first ship.⁸ In 1821 Manby and Napier obtained a French patent protecting the invention of iron hulls, and permitting them to be imported. A société en commandite was formed in 1822, and in exchange for the use of his patent, Manby received one-third of the company's share-capital of 600,000 F.⁹ This company was known as both the Cie Reynaud, after its managing director, and as the Société Parisienne pour les Bateaux à

Vapeur en Fer sur la Seine. About the third company little is known. It began operations in 1821 with one ship, the DUCHESSE DE BERRI, which carried passengers between LeHavre and Rouen.¹⁰ In 1823 it built another ship, the first of four more, for carrying goods over the same route.

The first few years after 1820 were favourable ones for the formation of new companies of this kind. After a sharp industrial and financial crisis in 1818, industrial production, prices and profits remained stagnant. Investment opportunities were few, and the returns to be gained usually small. Both in France and across the Channel there were abundant funds available without profitable employment. Late in 1820, says Bertrand Gille,¹¹ bankers were complaining of a "nullité des affaires", and an excess of credit, "presque inouïe". At the same time the volume of goods being carried on the lower Seine was growing fairly quickly, rising from less than 100,000 tons in 1819 and 1820 to almost 150,000 in 1822, and after a short fall in 1823 rising again to almost 180,000 tons in 1826.¹²

The performance attained by the new steamers was quite remarkable when compared with the traditional means of water-borne transport. Under favourable conditions their voyage times were very close to those of road transport, while their rates were about half. From LeHavre to Paris for example, roulage ordinaire took eight days and cost about 75 F per ton, while roulage accéléré took four days and cost about 115 F per ton. Steamers took about five days for the same journey and charged only about 50 F per ton. By the traditional allèges and bateaux normands, the trip could take up to six weeks and cost from 20 F to 40 F.¹³ The steamers of the Cie Magendie, using horses at some difficult passages, sometimes travelled from Rouen to Paris in less than two days. They could carry 90 to 115 tons with safety and relative regularity.¹⁴ Between LeHavre and Rouen steamers had the great advantage of avoiding the dangers of the traverse and the barre and eliminating the need to use the very poor tow-paths. Competition was very keen between companies to reduce their voyage times. In June 1822 the Compagnie Reynaud distributed a prospectus announcing that it would transport goods from LeHavre to Paris in the same time that the ships of the Compagnie Magendie took merely to go from Rouen to Paris. The latter then kept one of its ships at Rouen, fully loaded, and ready at any time to race the iron steamer

AARON MANBY when it appeared from LeHavre on its way through to Paris. In the event a race did take place in 1823 and the MANBY was beaten.¹⁵

Steamers also offered the first means of simplifying transport methods. Both these companies attempted to eliminate or reduce the costs and delay of trans-shipment at Rouen. With Captain Napier's influence, the Cie Reynaud obtained exemption from the normal obligatory customs inspection at Rouen,¹⁶ and its ships were able to steam right through to Paris. A decision by the Minister of Finance in January 1823 extended this exemption to all ships with sealed hatches, in effect all steamers.¹⁷ The Compagnie Magendie was less successful. Because its ships were unsafe for operation in the Seine estuary and could not be used on the Seine-Maritime, the exemption from customs inspection was of no use to it. The firm's manager made an arrangement with a firm in LeHavre which offered to run a speedier service of allèges to Rouen, and hand over to his steamers all goods destined for Paris,¹⁸ but this lasted only a few months before Magendie was forced into liquidation.

The advantages offered by steam shipping were considerable for a few goods, and for a few years, as the figures in Table 2 show, the volume of freight carried by steamers grew steadily.¹⁹ However, as a proportion of the total goods shipped these amounts were still very small. In 1824 the total tonnage both ways between Rouen and Paris was over 400,000 tons²⁰ and of this less than two per cent was carried by steamers. Even on the Seine-Maritime where the advantages of steam were larger and steamers soon assumed greater importance the volume of goods carried remained small. In 1824 they carried only about 5,700 tons,²¹ twelve per cent of the total goods carried by water from LeHavre to Rouen. The cost of steam transport simply remained too high for most goods.

Table 2

Goods Transport by Steam from Rouen to Paris, 1822-26.

	<u>Number of voyages</u>	<u>tonnes</u>
1822	12	1,416
1823	35	4,130
1824	66	7,798
1825	58	6,844
1826	48	5,664

The Problem of Under-Utilization. The greatest problem faced by these early steamers, and the reason for their high operating costs, was simply under-utilization. The cost of each ton carried was high because the steamers were unable to carry sufficient freight during the year to spread their total costs thinly enough. The main cause of this was the insufficient depth of the Basse Seine during three or four months each summer, which forced steamers to cease operations there. A second cause was frequent enforced idleness for maintenance and repairs, and a third, both cause and effect, was simply lack of demand for steamer transport.

The problem of insufficient depth, or to put it another way, of excessive draught, was most serious for the Cie Magendie. This company had four ships, built in 1820 and 1821, the GENIE DU COMMERCE, the DUC DE BORDEAUX, the VILLE DE ROUEN, and the VILLE DE PARIS, all of similar construction with a single paddle-wheel at the stern, and a draught when loaded of about 1m.60. It was estimated that owing to water depths sometimes being too low they could make only about eighteen return voyages per year.²² This of course reduced the number of tons over which annual operating costs could be spread. Certain costs were fixed from year to year and were related not to the amount of cargo carried, but to the value of the ship. For steamers this was much greater than for traditional bateaux. Their wooden hulls with a cargo capacity of about 100 tons cost 25,000 F, the same amount paid for a bateau normand of about 450 tons. Their thirty-horsepower engines, built in England by Aaron Manby, cost another 35,000 F each, plus a customs duty of 21 per cent;²³ French engines were said in LeHavre to be both higher in price and inferior in quality.²⁴ Amongst fixed costs were a large part of maintenance and depreciation, an economic interest on the value of the ship, and a share in the company's general expenses; there were also nine crew members on each ship in continuous employment. Some costs of course were related to the amount of cargo carried. fuel, droits de navigation, pilotage horses, and a certain proportion of maintenance and depreciation. But these were only 40 to 45 per cent of the total costs of owning and operating one of these ships. High fixed costs made the short season a serious problem. The cost per ton from Rouen to Paris was about 41 F, but according to a contemporary authority,²⁵ the

rate offered rarely exceeded 25 F. Competition was very severe with the rival Cie Reynaud, which could offer its superior uninterrupted service from LeHavre to Paris. In 1825 traffic seems to have declined considerably from the previous extraordinarily active year, and with insufficient revenue to satisfy its pressing creditors, the Cie Magendie was forced into liquidation.

The second cause of under-utilization, excessive enforced idleness for repairs, seems to have been especially serious for the third company, which operated only on the Seine-Maritime. The draught of its three ships, 1m.80 fully loaded, was too great for them to operate on the Basse Seine. This company was the victim of frequent engine failures, groundings in the Seine, and other mishaps, as well as being forced at times to suspend operations owing to low water. For these reasons, according to Tourasse and Mellet, contemporary authorities on steamboat design,²⁶ this company's ships were capable of only about twenty voyages per year. In fact, their performance was even worse; in 1826, the last full year in which the company's ships operated, the numbers of round-trip voyages made were: for the VILLE DU HAVRE, nine, the COLBERT, nine, and for the DUC D'ANGOULEME, fifteen.²⁷ The last of these ships had various stop-overs at LeHavre lasting eleven, fourteen and twelve days, and one of more than two months. The repairs themselves were costly, and together with depreciation, which occurred at a faster rate than expected, accounted for almost forty per cent (25,000 F of 67,000 F) of each ship's annual operating costs.²⁸ This company led a precarious and somewhat dangerous existence. On 2 March 1827 one of its ships, the COLBERT, ran aground on the "poulier du sud", a sand bank at the entrance to LeHavre, and had to be abandoned. Soon after this incident the company was forced into bankruptcy, and its two remaining ships and the COLBERT's salvaged engine were sold by auction.²⁹

The Cie Reynaud were able partly to overcome the first cause of under-utilization by their innovation in hull construction, the use of iron. The much higher capital cost of its ships made under-utilization potentially a more serious problem, but owing to their iron hulls, these ships were both shallower in draught and stronger in construction. Its iron hull gave it

a greater freight capacity (116 tons compared with the DUC DE BORDEAUX's 80 tons) for a smaller draught (1m.45 fully loaded, compared with 1m.60), and much greater strength to resist the dangers of grounding in the Seine-Maritime. It was powered by a single thirty-horsepower engine. This meant they were able to operate on both the Basse Seine and the Seine-Maritime, and so could offer a through service from LeHavre to Paris; this attracted more cargo and probably reduced the proportion of unproductive time spend in port. Of even greater importance for the survival of the company, stronger construction also enabled them to operate on the shorter route from LeHavre to Rouen in the low-water season. The company's first ship the AARON MANBY was the world's first iron ship. It was built at Manby's Horseley works and sent in sections down to London, where it was assembled and steamed for Rouen in May 1822.³⁰ Its advantages did not come cheaply; its initial cost was almost 150,000 F, compared with 60,000 F for the DUC DE BORDEAUX.³¹ Up to 1827 this company added four other ships, all with iron hulls and even greater capacity (120 tons) and greater horsepower (50 horsepower); these were the COMMERCE DE PARIS, the SEINE, the HIRONDELLE, and the CHARLES X.

According to calculations made by a committee of the Bureau de Commerce in 1826,³² these ships were able to operate for about nine months in a normal year between LeHavre and Paris. On average a voyage lasted eighteen days, leaving time for about fifteen each year by each ship. For the remaining three months of the year, the ships could operate between LeHavre and Rouen only, and make about eight more voyages. Under these conditions, the company could charge rates of about 55 F per ton from LeHavre to Paris and 25 F per ton to Rouen, and in the first three or so prosperous years when it had almost full loads on every voyage, the company obtained a net return on its capital of more than eleven per cent. Without the extra revenue from eight voyages to Rouen, this company would have been placed in the same position as its unfortunate rival the Cie Magendie; the entire burden of its fixed costs would have fallen upon revenue from regular voyages to Paris, and net return reduced to probably less than one cent.³³

After 1826, when prosperity and traffic declined, and when strong competition began from other innovations in transport, these profits were for a time reduced to nothing. The Cie Reynaud was forced to abandon its service on the Basse Seine,

and it was not resumed until 1831. High costs and resulting high freight rates were the reason; had these steamers been able to reduce the time needed for the difficult voyage from Rouen to Paris from five to two and a half days, costs would probably have fallen sufficiently to lower the freight there from 25 F to 20 F or less.³⁴ Competition might then have been successful.

At 25 F per ton the company could not attract enough cargo to fill its ships, and they were often forced to spend unproductive periods of several days or weeks waiting at the quayside. Excessive building of new ships before the end of 1826 had created too much capacity and added considerably to fixed costs. On 12 June 1826, some months after the financial and industrial crisis had begun, the company bravely announced in the Journal de Havre that in future it proposed two regular sailings each week from LeHavre and from Paris. A close examination of the arrivals and departures of the company's ships at LeHavre³⁵ however, indicates a very irregular pattern, averaging from 18 June to 31 December 1826 1.4 arrivals per week; the number of arrivals in a week ranged from none to five, of departures from none to three. During the same period, the times spent in LeHavre averaged about a week for the MANBY and the SEINE, and two to three days for the CHARLES X. At about this time, the end of 1826, a dispute occurred in the company between Captain Napier and Varnier, the company's agent in LeHavre. Napier accused Varnier of mismanagement, and particularly of allowing the ships to remain too long in LeHavre between voyages;³⁶ each ship was equipped with a small derrick, and Napier believed that with the help of these only eight to twelve hours were needed for cargo handling. Varnier of course denied the accusation of mismanagement;³⁷ he said that turnaround times could not be reduced below two days. Furthermore, he pointed out, there was not enough cargo for any more voyages; each ship could at most do three voyages per month—at present they never left with a full load—and Napier's demand for six each per month was quite impossible. Sugar seems to have been the only substantial cargo upstream, and after May 1826 there was competition for this from barges pulled by steam tugboats at a lower rate. The shortage of return cargos was even more

accute. The company advertised in the Journal de Havre (12 June 1826), suggesting that

MM. les négociants qui chargent à bord des navires américains trouveront de l'avantage à recommander à leurs correspondants de Paris, d'expédier leurs marchandises par les Bateaux à vapeur en fer....

But the suggestion was not taken up. All that remained were partial and poorly paying cargos of flour, wine, empty casks, plaster and other kinds of ballast.

Interest payments seem to have been kept up only out of the company's capital, by neglecting maintenance. At the beginning of December 1826 M. Reynaud died, and by the terms of the acte de société of 21 February 1825, the company had to be liquidated. The liquidator kept the ships operating until a new company could be formed in the following July. The new company, called Delaistre et Compagnie, bought the assets of Reynaud et Compagnie (five steamers with iron hulls, two of them built in 1826) for only 280,000 F;³⁸ the value of the AARON MANBY and the COMMERCE DE PARIS alone had been officially assessed at a total of almost 385,000 F in July 1825.³⁹ Of the three steamer companies formed in the early 1820s, only this one survived into the next decade. By 1831 the proportion of total traffic carried in steamers reached what was probably a maximum at almost nine per cent.

Attempts to Solve the Problem of Under-Utilization.

Other more economical ways of using steam power were evidently needed if its potential benefits were to be realized. One way, which was obvious in its simplicity, would be to separate the steam propulsion unit from the cargo-carrying vessel. In this way the costly steam engine would not be forced to remain idle while the cargo was unloaded, its considerable weight would not occupy scarce cargo space, and it could be put to a greater variety of revenue-earning uses. In principle, the separate propulsion unit could be used either to push or pull the cargo vessel. Both ideas were tried, but after a brief false start with pushers, it was the tugboat which, beginning in 1826, proved successful.

A False Start with "Pushers", 1824-26. One obvious method for combining separate propulsion and carrying units was to have one push the other. With this object a société en commandite

was formed on 31 December 1822 to exploit a patent recently obtained by its promoters, François Margéridon and André Frossard, for their invention of a so-called "bateau articulé".⁴⁰ Little is known about this company, and it never succeeded in operating more than intermittently before it collapsed in 1826. Its capital however, must have been large, as it built four steamers of 40 to 80 horsepower, nine "porteurs" of 120 to 180 tons, and several smaller craft. It began its career during 1823 and 1824 on the same short wave of easy credit, and limited expansion of traffic, as had the other steamer companies, and evidently it hoped to undercut their rates. With one steamer, the new "Entreprise des Transports par Bateau à Vapeur, du Havre à Paris", obtained an agent in LeHavre, M. Cottin, whose allèges to Rouen were to provide a temporary connecting service. During 1825 and 1826 the company received three more new ships, and in January 1826 they announced the beginning of a twice-weekly service direct from LeHavre to Paris, to take eight days at the most.⁴¹ This however, was evidently too ambitious, and in July another announcement was made that service would be reduced to once a week, and maintained "aussi régulière que possible".⁴² Very soon the company was divided in two: Lecoq and Lavenant taking over operation between LeHavre and Rouen, which it is doubtful had ever begun, and Bouvet and Devertpré those from there to Paris. Very soon after both succumbed to bankruptcy. In the first months of 1827, when traffic on the Seine fell sharply from the previous year, judgements were obtained against the original company in LeHavre in favour of Aitken and Steel, builders of its steam engines, for over 52,000 F.; in July its other assets were also sold by auction.⁴³ The reasons for its failure are not clear. Tourasse suggests⁴⁴ that its ships were too slow, partly owing to serious difficulty in steering with stern paddles. Full services were also delayed by a lawsuit for invasion of patent rights; its finances were probably compromised as well by the financial crash at the end of 1825, just as its two last ships were being finished.⁴⁵

The Success of Bertin et Cie., 1826. A definitive solution to most of the economic and technical problems of steam propulsion was found in the tugboats and barges of the Compagnie Bertin. They began operating from LeHavre in May 1826, and for

the first seven or eight years the tugs went only as far as Caudebec or Rouen; the barges, called chalands, were then towed on to Paris by relays of horses. It was only after about 1833 that Bertin's tugs and others of similar design extended their operations to the Basse Seine and to Paris.

The innovation made in 1826 was evidently the idea of Alexandre Bertin of LeHavre, a modest négociant in LeHavre engaged in trade with the Baltic area. He frequently advertised in LeHavre to sell naval stores, firearms and furs.⁴⁶ He seems therefore to have had no previous direct interest in transport on the Seine. The identity of his associates in financing the tugboats and chalands is not known; later, in the 1840s, and probably some years earlier, shares in the company were traded on the bourses of LeHavre and Rouen.⁴⁷ It was not until 1 August 1826, when his tugboat REMORQUEUR and about ten chalands had been operating for five weeks, that he formed a société en commandite with Jules-Ernest Nay of Paris, who seems to have been a commissionnaire de roulage. Less than a year later this company was dissolved and succeeded by another, with Pierre-Marc Rey-Thorin, négociant, also of Paris.⁴⁸ The company's capital at this stage was 400,000 F.

The keys to competitive success for Bertin's innovation were a lower unit cost and a high standard of performance, achieved by intensive use of the company's good equipment. The company's chalands were smaller than other commonly used river craft, about 200 tons capacity, and therefore shallower in draught, more manoeuvrable and faster in shallow water or narrow passages. They were very strongly built of wood, and safe against the dangers of collision and grounding in the Seine. REMORQUEUR NO.1 (it was followed by two sister-ships) was a large and powerful steamer for its time; its 80-horsepower engine, built by Manby and Wilson at Charenton, enabled it to pull 300 tons at twelve kilometres per hour (the ships of Reynaud et Cie. could do about thirteen kilometres per hour).⁴⁹ With its assured speed and considerable power, it could get past the traverse and avoid the barre, arriving at Caudebec or Rouen on a single tide, thus saving the vessels it pulled much time and exposure to danger. When the tug was not pulling a chaland to Rouen, it could be gainfully employed in a second role, towing coasting vessels over the same route. In either case, once the vessel

under tow was delivered to its destination, the tug could begin another job, and not stand idle while the cargo was handled; it could often return to LeHavre the same evening. Tourasse calculated⁵⁰ that these tugs could do eighty return voyages per year; in 1827 REMORQUEUR NO.1 pulled 63 chalands to Rouen, plus an unknown number of other ships.⁵¹ Therefore even with annual fixed costs for maintenance, depreciation and interest running to 30,000 F (compared with only 22,500 F for one of the iron steamboats), the cost per ton from LeHavre to Rouen was kept down to about 13 F.⁵² -The same voyage cost 14 F per ton to the Cie Reynaud.⁵³ The chalands were therefore able to compete very effectively with the steamers for goods needing fast transport.

Navigation Accélérée, a Conservative Solution. Like roulage accéléré, navigation accélérée involved no new means of propulsion, but was merely a reorganization of the traditional one. The capital investment required was negligible. Although Bertin's chalands used this system on the Basse Seine for a few years, its main operators were of another kind. To provide navigation accélérée groups of individual mariniers, each with one and sometimes two boats, formed co-operative associations. The first of these, and the least obscure to the historian, was the "Bateaux accélérés normands" formed early in 1826 apparently with the leadership of Henry Maillet-Duboullay, a courtier de commerce at LeHavre. Their object, they said, was to provide greater speed and order, while preserving their traditional economy. For this no "grande et nombreuse administration" of the kind organized by the steamer companies would be needed. The members of the group, they said in 1826,⁵⁴

convaincus par une vieille expérience, ont regardé comme démontré, qu'une amélioration réelle et constante doit être obtenue, non par des nouveautés irréfléchies, mais par le perfectionnement des moyens déjà connus par la pratique.

The means they would use were three. Loading of the association's boats would be done by turns (à tour de rôle), and departures would be regularly scheduled. Secondly, continuous movement would be assured by a constant supply of relay horses, provided to the association by contractors. Thirdly, to facilitate this continuous movement, authority would be obtained from the central Administration for trématage;⁵⁵ this was the

right to overtake and to take priority of passage at weirs and bridges over other slower boats voyaging à longs jours, without relays. This was granted to Maillet-Duboullay and the Bateaux accélérés normands by the Minister of the Interior in June 1826.⁵⁶

This new method made possible considerable improvements in service, especially in speed, at little extra cost. Fixed costs for interest, depreciation and maintenance were not increased, since the same traditional boats were used. Underutilization was therefore not a serious economic problem. Overhead costs for administration hardly existed, whereas they had accounted for about eight per cent of the annual expenditure of the steamboat companies. The day-to-day business of the mariniers in LeHavre, Rouen and other ports was handled by agents or brokers called cochemates. They and their commis, in the words of the Prefect of the Seine-Inférieure,⁵⁷ were the

commissionnaires des mariniers et pourvoient à tout ce qui concerne le chargement et le déchargement des bateaux, guident et conseillent les mariniers dans leurs divers rapports avec le commerce d'une place que la plupart d'entre-eux ne connaissent pas.

For their services, the cochemates received from the consigners of goods a commission of three per cent. The extra cost of relays seems to have been slight, perhaps three or four francs per ton added to the normal rate which varied between 12 and 20 F per ton. For this voyage times were considerably reduced, to about seven days in winter and ten in summer.⁵⁸

The success of the Bateaux accélérés normands seems to have been so immediately evident that they were soon imitated by several others, and by 1828, as Table 3 shows,⁵⁹ only about one-fifth of the goods transported on the Basse Seine were being carried by the traditional slow means. In August 1826 the Sieurs de Riberpré, père et fils, with a fleet of sixteen boats, obtained rights of trématage, and within a year merged with the Normands.⁶⁰ M. Fleury-Desseaux of Rouen headed another association of about twenty-five owners of thirty-one boats, and a M. Molet formed a fourth group. With the chalands of Bertin, this made a total of four companies operating accéléré. During 1830 and 1831 there were two other small companies which also carried a small amount of goods.

Table 3

The Movement of Goods Upstream on the Basse Seine
from 1828 to 1831 (tonnes).

	<u>1828</u>	<u>1829</u>	<u>1830</u>	<u>1831</u>
TOTALS	169,211	182,415	209,056	145,801
Bateaux à longs jours	34,279 (20%)	34,365 (19%)	52,862 (25%)	21,145 (21%)
Bertin et Cie	20,487 (12%)	23,539 (13%)	20,827 (10%)	24,319 (17%)
Delaistre et Cie	-	1,413 (1%)	1,337 (1%)	12,724 (9%)
Bateaux accélérés:				
Bateaux accél- érés normands	62,276	72,314	63,949	39,920
Fleury-Desseaux	33,374	28,841	30,011	18,449
Molet	18,796	17,381	30,323	23,949
Herfort et Cie	-	-	-	2,670
Delanneau et Cie	- (67%)	- (66%)	4,540 (62%)	1,103 (60%)

The benefits from these innovations came in three forms, in the availability of greater speed and improved safety in water-borne transport and in reduced traffic on the roads between LeHavre and Paris. They may also have forced a slight reduction in the cost of river transport by the traditional means. By the use of steamers, voyage times between LeHavre and Rouen could be reduced to a day or so, and those in the much more difficult Basse Seine to about five. Voyage times between LeHavre and Rouen by the more economically viable chalands were reduced to about two days from what had formerly been up to a month in allèges; by the use of tugboats they had also been made much safer. The same benefits of increased safety and speed had also been brought to allèges and coasters by their use of tugboats. Voyage times by the grosse marine operating accéléré between Rouen and Paris were reduced by 1834 to between twelve and fifteen days from what had formerly been up to a month.⁶¹ Chalands operating on the Basse Seine, where they were still towed by horses, were able to travel from Rouen to Paris in five

to eight days.⁶² The greater availability of speed on much cheaper water-borne transport produced a marked beneficial effect on the volume of road traffic. Pierre Frissard, the Ponts et Chaussées ingénieur du port at LeHavre, wrote in 1832 that since 1824 road transport between LeHavre and Rouen had been reduced by half, from about 20,000 to about 10,000 tons per year.⁶³ Schwilgué, the ingénieur des routes for the Seine-Inférieure during the late 1820s confirms that it had a similar though less marked effect between Rouen and Paris.⁶⁴ The advantages of fast river transport over the road were enthusiastically pointed out by the Chambre of Commerce in LeHavre in 1829;⁶⁵ the bateaux accélérés it said, could

effectuer leurs transports dans un délai aussi court que celui employé par le roulage; qu'ils ne prennent que la moitié du prix de celui-ci, et qu'encore la marchandise toujours à couvert, et ne recevant pas les secousses inévitables d'un transport par terre, est beaucoup mieux ménagée, et n'éprouve pas de coulage, comme elle le fait par le roulage.

The effect of these innovations upon the price of transport is not clear, though because of increased speed, safety and reliability, their overall impact must have been to reduce total transport costs. According to a report to the Chambre of Commerce in Paris in 1831,⁶⁶ the cost of transport from LeHavre to Paris by chaland varied between 18 F and 21 F according to conditions on the river and the type of goods being carried. This was little different from the rates charged by bateaux ordinaires accélérés, whose speed was slower. According to another source, the bateaux ordinaires had even been able to lower their rates after a few years of operating accéléré. Charles Bérigny, ingénieur-en-chef des ponts et chaussées wrote in 1834⁶⁷ that average rates for bateaux ordinaires accélérés had fallen by about one-quarter since the late 1820s. Apparently contradictory evidence is given by Michal,⁶⁸ another ingénieur des ponts et chaussées, who reported in the early 1850s that no long-run downward trend took place until after the advent of railways in the mid-1840s. He gave annual maxima and minima charged for horse-drawn river transport between Rouen and Paris beginning in 1827, which are shown in Table 4. Because of wide seasonal variations in rates it is difficult to choose between the evidence given by Michal and by Bérigny.

Table 4

Annual Maximum and Minimum Freight Rates
for River Transport from Rouen to Paris, 1827-1850
(franc per ton)

	<u>maxima</u>	<u>minima</u>		<u>maxima</u>	<u>minima</u>
1827	19.20	10.55	1839	16.20	12.50
1828	12.70	9.90	1840	17.60	11.90
1829	14.15	10.80	1841	18.60	10.70
1830	16.00	14.50	1842	24.10	12.60
1831	13.30	11.70	1843	19.00	10.50
1832	13.40	10.70	1844	13.80	10.90
1833	19.90	11.10	1845	13.00	11.00
1834	16.80	12.30	1846	13.40	11.00
1835	15.10	11.40	1847	11.65	10.50
1836	16.30	11.50	1848	10.20	10.00
1837	16.50	13.30	1849	10.40	9.50
1838	14.20	10.90	1850	9.20	8.80

The Threat to the Port of Rouen

Rouen's position, between LeHavre and Paris, was a very vulnerable one, and owing to the improvements described above it was becoming increasingly so. To gain time and reduce handling costs, one of the chief preoccupations of transport operators was to organize direct transport from LeHavre to Paris; the chalandes of Bertin et Cie, the maritime canal, the steamers of Reynaud et Cie, and later the railway all had this object in mind. Yet the future prosperity of Rouen's port depended upon maintaining a break in navigation at Rouen, and its defenders opposed almost every attempt to eliminate it. As an alternative to this its only strategy could be to attract ocean shipping up the dangerous river beyond LeHavre, to be the competitor of LeHavre. This competition for ocean traffic had begun in the late eighteenth century, as overseas shipping increasingly shifted its base from Rouen to the deeper harbour at LeHavre.⁶⁹ To attract these ships back to Rouen two things were needed, greater depth and greater safety in the Seine-Maritime between LeHavre and LaMailleraye, and throughout the nineteenth century the Chambre of Commerce in Rouen, followed by the municipal Council, vigorously promoted these two objects. While the Ponts et Chaussées studied the complex problems of how to obtain the first, Rouen tried in the 1820s and the 1830s

to organize the second.

The operation of tugboats for ocean and coastal shipping on the Seine-Maritime was first proposed in 1822 by a maritime insurance agent at Rouen. Similar proposals continued to be made through the 1820s and most of the 1830s.⁷⁰ The potential value of such an innovation was admitted by all; to make it an economically viable operation however, proved a difficult and complex problem. Fundamentally, the problem was the familiar one in transport of the need for a large initial investment, with the added difficulty of a considerable time-lag between the payments made by individuals who would benefit and the benefits they would receive. An initial investment in tugboats of about 500,000 F was needed; annual operating costs were estimated at about 125,000 F. To recover the capital with interest and pay the operating costs, charges on users would be needed. If however, the charge were made to the ship being assisted, freight-rates would immediately go up and frighten away traffic. Shippers and receivers of cargo were unlikely all to wish to pay this increase without an immediate lowering of other costs, particularly loss and damage, insurance premiums, and the costs of time. Several possible remedies to this dilemma were suggested. The first was a compulsory charge on all ships in the Seine-Maritime to pay operating costs and a compulsory division of a rate charged to users of the tugs to pay capital costs. This was resisted by the Ministry of Marine and the Directeur-général des Ponts et Chaussées, neither of whom thought a compulsory charge could be levied for what they considered to be a project of purely local interest; they wanted a private company to undertake the scheme. A law of 24 March 1825 providing for the droit and demi-droit de navigation to be handed over to local authorities to finance transport improvement projects gave an alternative to this compulsory charge, but the Directeur-général des Ponts et Chaussées found that the tugboat scheme did not come within its terms. The compulsory division of a freight-rate between the ship and the goods (in the proportions successively suggested of 1/5-4/5, 1/4-3/4 and 1/3-2/3) was found to be contrary to Article 406 of the Code de Commerce, and all attempts to have this amended failed. The alternative of course was to run tugs as a normal commercial venture. This

was suggested in September 1824, and the Chambre of Commerce in Rouen, on the initiative mainly of Jean Rondeaux, one of its members and a négociant in Rouen,⁷¹ obtained permission to import two or three boats from England. Forty-four merchants in Rouen undertook to pay four-fifths of the rate to be charged for the service. It was hoped that its benefits would soon become evident to all, and this unnatural system of charging be replaced by the ordinary freight-rating system. Taking wine, one of Rouen's largest imports, as an example, Rondeaux estimated that net savings of 1.25 per cent on the value of the goods could be obtained. A tugboat⁷² began operations late in the spring of 1825, but after only two months was forced to stop. Technically the service had been very successful, but a large number of merchants refused to pay their four-fifths share of the tugging charge upon receiving their goods, and the company could not recover its costs. This only served to demonstrate the need for a compulsory charging system.

For such a high-risk venture capital funds were very difficult to obtain. Despite the importance of this project for the future of Rouen, local people could not be persuaded to invest in it. In 1826, fearing that ill-effects would follow from the recently begun direct service by chalands from LeHavre to Paris — the Chambre of Commerce had already during 1825 opposed the railway proposed by Navier — Rondeaux distributed a questionnaire to local négociants, shipping brokers, ship-builders, ship-captains and pilots, asking first whether Rouen was indeed being reduced "au rôle de spectateur oisif des passages qui s'opèrent le long de ses rives sans y aborder,"⁷³ and if they believed this to be so, whether tugboats might be a remedy. Those who answered agreed that Rouen was threatened, and that tugboats offered a good solution to the problem. However, only 41,000 F of the necessary 300,000 F were subscribed to the company and the idea had to be dropped.

The only alternative remaining was a set of commercial expedients to ensure economies to users of tugs, and reliance upon the tugs of Bertin to pull ships when no chalands were available. Early in 1828 the Chambre of Commerce persuaded Rouen insurance brokers to reduce their premiums by one-quarter for both hull and cargo using tugs. At the same time the Chambre of Commerce announced that it would try to persuade the

Administration to alter the law so that any emergency in which use was made of a tug would be classified as avarie grosse,⁷⁴ in which case the receiver of the goods would be obliged to pay part of the cost of tugging. Ship-owners were in the meantime encouraged to stipulate in contracts that tugs should be used in circumstances of avarie grosse. To relieve ship-captains of the need to add the tugging charges to their freight-rate, the réglement de pilotage, over which the Chambre of Commerce of Rouen had been given control during the previous century, was amended in August 1828 to give a rebate of one-quarter of pilotage dues to those using tugs. This unsatisfactory patchwork of expedients lasted for a few years. Bertin helped to increase its success by stationing one of his tugs for a few years in the Seine-Maritime between Quillebeuf and Caudebec. After 1836 in conditions of greater prosperity Rouen obtained its own independent tugging company, but the threat to her maritime commerce was never kept long at bay.

Greater Efficiency Through Regulatory Change.

Although the innovations made during the 1820s increased the speed and economy of transport in the Seine valley, they also created new problems. The new systems of navigation accélérée and chalandage were soon discovered not to be entirely compatible. Moreover, the regulations governing transport on the Seine since the time of the Consulate were found to hamper efficient operation of the small chalands. Reforms were suggested and attempted in the 1820s, but were successfully implemented only in the 1830s. Such reforms were important if the full benefit from innovations made during the 1820s was to be obtained. The Administration des Ponts et Chaussées was fairly active at this time in promoting improvement of water-borne transport, but unfortunately its regulatory powers were inhibited by its own, the government's and parliament's understandable reluctance to damage economic interests, regardless of their apparent inefficiency. In any case, economic efficiency was not yet regarded as the primary criterion in such matters. During the July Monarchy however, largely following the impetus given by its Directeur-général Legrand, the Ponts et Chaussées undertook several important reforms and innovations.

The speedy operation of transport on the Seine was hampered by a system of regulations begun under the Consulate and Empire which tended to encourage the use of very large boats. Most important was the octroi de navigation intérieure fixed by a law of Floréal An X (1802).⁷⁵ User charges were imposed in order to finance badly needed maintenance and improvements. However, the method of charging was too crude, with the result that not only did the tolls vary greatly from one river basin to another (which might be considered reasonable), but also from place to place on the same river, and from one size of boat to another. The basis for assessing the tax to be paid was simply the length of the boat; no systematic account was taken of the distance travelled, collection bureaux being located only as custom dictated. The chief effect of this was to encourage boats with the greatest possible ratio of capacity to length, and to discourage use of smaller, faster boats, like the ones used by Bertin et Cie. Under the law of 1802, according to calculations made from a parliamentary committee in 1834,⁷⁶ the effective charge upon a large boat of 48 metres in length and 480 tons capacity was about 0.536 F per ton of cargo for a journey from Rouen to Paris and return; for one of 38 metres and 250 tons it was about 0.831 F per ton; for one of 33 metres and 200 tons it was about 0.901 F per ton; for one of 30 metres and 100 tons about 1.528 F per ton; and for a flette of 21 metres and 10 tons, about 4.745 F per ton. The effects of this system of tolls began to be serious only when the wars of the Empire had ended, and the normal volume of transport had been re-established on the Seine. By about 1820 nine-tenths of the goods shipped from Rouen to Paris were being carried in large bateaux normands. Since their draught was greater they were generally slower and their general use tended to decrease the speed of transport on the river and force more traffic onto the roads.

An unsuccessful attempt was made in the 1820s to reform the droits de navigation, as they had become known. There were complaints from all parts of the country against the inequity of the system set up in 1802. On the Seine operators and owners of the petite and moyenne marine, and the owners of the Paris canals which could not accommodate boats of the grosse marine, were particularly vocal. The initiative for reform was taken

by the Minister of the Interior in 1820,⁷⁷ and in 1821 a commission mixte of the Ministries of the Interior and Finance was appointed to study the problem and recommend changes. The result was a projet de loi presented to parliament in 1824.⁷⁸ Lacking a reliable method of measuring the real load on board a boat, the commission had proposed to tax boats on their total capacity. However, after the projet de loi was strongly criticized by the mariniers of Normandy who feared that its effect would be to greatly increase the droit,⁷⁹ the commission changed its recommendation and the bill had to be withdrawn.

With the growth of navigation accélérée from 1826, a solution to the problem became increasingly necessary. Bertin's chalands were particularly hampered by having to share the right of trématage with the large bateaux normands of Maillet-Duboullay and later others. Neither could overtake the other, although the chalands were usually capable of going faster particularly in low water. Charles Dupin stated in 1829⁸⁰ that the petite marine was capable of doing the voyage from LeHavre to Paris in eight days; owing to delays caused by slower large boats however, their voyage time was increased to 14 or 15 days. The conflict grew as traffic increased in the second half of the 1820s. The effect it had upon the operational efficiency of Bertin's chalands can be seen by a close examination of the movement of goods in bateaux accéléérés of the grosse marine and in chalands at various seasons from 1828 until 1831, when the first reform occurred.⁸¹ At all seasons the large bateaux accéléérés normands carried more goods than Bertin's much smaller and less numerous chalands. Moreover, during the month of August when water depths were smallest, the proportion of the total goods transported by both of these increased; this was the season when river transport was most difficult and slow, and when shippers made greatest use of navigation accélérée to maintain speed. Although the smaller chalands suffered much less from low water than the larger boats of Maillet-Duboullay, and might have been expected to increase their proportion of the total traffic at low water, the division of traffic between chalands and bateaux accéléérés remained constant. Owing to their equal rights of trématage, both were reduced to the same speed. During August of 1831 however, after some reform had taken place, a new trend seems to have occurred; the percentage of goods carried by chalands increased, while that carried by

bateaux normands, both accélérés and à longs jours decreased.

Complaints from Bertin and other operators of the petite marine, and concern expressed by the Compagnie des Canaux de Paris, prompted Becquey, the Directeur-général des Ponts et Chaussées, to revive the earlier attempt at reform. Late in 1828 with the support of the Minister of Commerce,⁸² Becquey had commissions of inquiry established at Rouen, Evreux and Versailles.⁸³ Rival interests soon manifested themselves. A large group of négociants and mariniers, owners of the petite marine, including many from the Oise and the Marne, sent petitions to the Minister of Commerce in favour of reform.⁸⁴ Only one of the mariniers was from Rouen, centre of the marine normande, the grosse marine. The Chambre of Commerce in Paris wrote in favour of reform,⁸⁵ as did the Chambre of Commerce in LeHavre.⁸⁶ The grosse marine and the Chambre of Commerce in Rouen were opposed to reform; Rouen feared once again that growing use of navigation accélérée would result in increasing numbers of boats going direct from LeHavre to Paris.⁸⁷ The Administration's point of view, expressed in 1831, was that it seemed, in effect, "peu juste d'enchaîner à la suite de la grosse marine celle qui peut effectuer en huit ou neuf jours ce qui, pour l'autre, est l'affaire de dix à douze."⁸⁸ Only a partial reform was achieved, and only after considerable delay. A conference of boat owners agreed on a simple formula which allowed the faster boats priority of passage;⁸⁹ reform of the droit de navigation and eventual reduction in the numbers of large boats had to wait.

As indicated above, this reform seems to have had beneficial results. Bertin's chalands took over a larger proportion of traffic during the late-summer low-water season. However, 1831 was a year of greatly reduced traffic, almost a third less than in 1829. During 1832 traffic resumed much of its previous volume, rising by 21 per cent and in November 1832 after what may have been another difficult low-water season, the Cie Bertin again petitioned for reform. The petite marine was still unsatisfied with the discriminatory droit de navigation.⁹⁰ Bertin was again supported by the Chambre of Commerce in LeHavre,⁹¹ and also more importantly this time by a petition from 54 of the most important firms, banks, négociants and armateurs of LeHavre.⁹² LeHavre was a stronghold of Orleanist opinion, and Thiers, the recently appointed Minister of the Interior, marked the petition

for prompt attention. Within a fortnight the petitioners were informed that their requests would be given careful consideration. On the same date, the comte d'Argout, Minister of Public Works, requested Legrand that the reform abandoned in 1825 be taken up again; the droit de navigation should be based, he wrote, upon the load being carried in a boat, not upon its length, and a new schedule of charges and classification of goods should be drafted, based upon the value of goods and their use by industry. Special attention was to be given to the problems of navigation accélérée.⁹³ Within thirteen months, in February 1834, a projet de loi for radical reform was presented to the Chambre des députés.⁹⁴

The bill for reform of the droits de navigation on the Basse Seine was intended to be a test of general principles to be applied later, if successful, over the whole country. Whereas the drafters of the 1802 legislation seem to have been concerned only with raising revenue, the concern of the Administration in 1834 was also with the effects the tax would have upon the efficiency of transport. An attempt was made to formulate a 'neutral' tax, one which over the long-run favoured no size or type of boat or commodity. As the Minister of Finance stated in introducing the more general legislation in 1836,⁹⁵

On a reconnu que le prix des transports par eau, devant en général être proportionné à la distance parcourue, au poids des marchandises, à leur valeur relative et à l'encombrement qu'elles occasionnent à bord des bateaux, les mêmes éléments devaient entrer dans l'assiette de l'impôt.

The tax, he continued, should be levied upon the amount of goods carried, not upon the size of boat whatever its load. The new system proposed in 1834 was for loads to be determined by a simple "échelle métrique" measuring displacement, which would be required on all boats. This method had been considered impractical in 1824. Two classes of goods were established, the second to be taxed at only half the rate on the first. In the second class were placed goods with a very low value per ton, notably coal, whose movement all wished to facilitate, and charcoal, peat, manure, fertilizer, sand, slate, tiles, bricks, stone, firewood, and timber. The schedule of new rates in the projet de loi, intended to recover the same revenues as before, suggests that the Administration wanted actively to discourage growth of the grosse marine. For a typical return journey the toll on goods carried in the largest boats would be more than doubled,

from 0.536 F per ton to 1.17 F per ton; this would probably have increased total costs per ton-kilometre by about one-eighth.⁹⁶ The rates for all sizes of boats, except the smallest of about 100 tons, would be raised by diminishing amounts.

Naturally all operators protested against these proposed increases, which would have affected the accélérés as well as the grands bateaux normands. The commission of the Chambre des députés was more concerned to protect established economic interests, and to lower the toll for all users —another commission in the following year, 1835, asked that the droit de navigation be entirely abolished —and after hearing submissions from the boat owners, considerably altered the proposed rates. It recommended that the proposed rate per ton be lowered from 1.17 F to 0.715 F, with the effect that the toll would be raised only for the largest class of boats; the toll for other classes of boats would be lowered, though in diminishing amounts, so that the smaller craft would gain a relative advantage. The commission also recommended postponing implementation of the new law from the 1st of July to the 1st of September 1834 to give operators more time to comply with its requirements.⁹⁷ The operators seem to have cooperated fully in the new scheme of assessing tolls, and all seem to have agreed that it was entirely successful, at least from an administrative point of view. In 1836 it was extended to cover thirteen other main rivers and canals. Its economic effects seem to have been much longer in manifesting themselves.

There was another minor reform in these years which contributed modestly to greater efficiency. All along the Seine at every bridge, weir and rapids, there were agents of the Ponts et Chaussées employed to act as pilots, to give assistance to passing boats and of course to collect fees for their services. The origin of these agents, who existed only on the main rivers leading to Paris, the Seine, Yonne, Oise, Marne and Aisne, was the Service d'Approvisionnement de Paris, organized in 1672, and responsible for the supply of timber and firewood to the capital. Considerable reorganizations had taken place in 1789 and in 1799, but by 1830 the service was in great need of reform.⁹⁸ The question was considered by the commissions of river users which were convened in 1829, visits were paid to

the places where agents existed, and recommendations made for reforms. As a result, several chefs de ponts and their aides were eliminated, or their numbers reduced, while others were increased in number; their salaries, and the fees which paid for them, were adjusted to fit more closely the extent of their duties.⁹⁹ The fees to be paid to the remaining chefs, aides and gardes at eight bridges and four weirs or pertuis, were adjusted and graduated to length and tonnage carried.¹⁰⁰

These reforms did not remove every possible cause for complaint. Steamers and remorqueurs were still subjected to several unnecessary regulations. For example, they were required to be handed over to a chef de passage at all the pertuis on the Basse Seine; this seemed a little irrational, said one eminent observer in 1836,¹⁰¹ "car qui mieux que le pilote connaît l'effet et la force de son gouvernail?" On the Seine-Maritime every chaland was required to have a pilot in addition to those on the tug pulling them.¹⁰² Bertin and the Chambre of Commerce in LeHavre attempted to have these requirements relaxed,¹⁰³ and although they were not entirely successful, the pilotage dues on steamers were reduced to half by an ordonnance of 1841.¹⁰⁴

PART TWO

Innovations during the 1820s had successfully applied steam power to the propulsion of river-borne and railway transport vehicles. The task which remained was to provide the infrastructures, an improved river channel and a railway track, on which these vehicles could economically operate. The State had not played an important role in the successful innovations of the 1820s. It now became much more closely involved. The railways required large amounts of land and finance capital, and in order to obtain these economically, they needed intervention by the State. The State was even more intimately involved in river-borne transport, for both institutional and economic reasons. The Administration des Ponts et Chaussées and its large corps of engineers had gained almost a monopoly of technical expertise and administrative control over most of the country's waterways. The economic structure of transport on the Seine and on other waterways tended to perpetuate this institutional arrangement. On each waterway there was a multitude of small independant operators, who had neither the means nor the financial incentive to become directly involved in improving their infrastructure. Successful intervention by the State to promote the development of railways proved to be very difficult. It required not only adequate private and public financial means, but also the political will both nationally and locally to bring them together. The main obstacle to improvement of the lower Seine was the lack of adequate technical means. This obstacle was removed by 1840.

CHAPTER FOUR

The Railway to the Sea, a Decade of Frustration

When the maritime canal project was finally abandoned in 1832 there were barely fifty kilometres of horse-drawn railway in operation in France. Yet within only eight years, by 1840, railways had become a well proven method of transport for both passengers and goods, and well over 2,000 kilometres of line were in operation in Great Britain and on the continent of Europe. Of this total however, barely 300 kilometres were in France. Although public interest in railways grew steadily from about 1830, and the many difficult issues they raised were actively debated, inability to resolve these issues during the following decade, and perhaps equally important, the inability of the economy to provide adequate financial and material resources for the task of building railways, left France far behind its neighbours in railway development. The most important issue, upon which agreement was not reached until 1842, was that of who should be responsible for financing and building railways, and if left to private companies, how if at all should these companies be assisted by the State. For the railway from LeHavre to Paris, another question of particular importance was which route should be followed. During the 1830s no final answers were given to these questions, and attempts by four companies and by the Ponts et Chaussées to organize and build a railway through the Seine valley led to nothing.

The Beginnings, From 1831 to 1835.

These years might be called the 'naive period' for French railways. Though several companies were formed to build railways, very little was known of their costs or the technical problems involved in their construction. In the beginning, planning a railway was little more than an exercise of faith. As Maurice Jouffroy has remarked,¹

il n'est pas certain que, à notre époque, où domine essentiellement un rationalisme plus organisateur qu'intuitivement créateur, une telle entreprise ne serait traitée de folie et ne serait-elle pas tentée. L'atmosphère romantique des années 1830 le permet.

It was soon learned that enthusiasm was no adequate substitute for knowledge. Real knowledge however, was still very small, for railway engineering was still in its infancy and the little experience acquired in the 1820s had become obsolete with the advent of effective locomotives. The design criteria for the permanent way had become much more exacting, with the effect that construction costs were considerably increased. The cost estimates contained in the project submitted by Mellet, Henry, Ruolz et Cie in 1832 were based upon their own limited experience since 1828 in building the railway from Roanne to Andrézieux. This railway had been designed to accommodate locomotives over only half its length, the remainder comprising a series of inclined planes with very steep gradients. Compared with the eventual cost of this railway of 90,000 F per kilometre,² Mellet et Cie estimated that the line from Paris to Rouen, which had to cross a series of river valleys and plateaux, would cost only 84,000 F per kilometre.³ To have done an exact survey and cost estimate would have been very costly, and was avoided by the company. Its plans therefore were rather vague, and the project it submitted in 1832 contained nothing more, in the words of the Conseil-général des Ponts et Chaussées, than an "indication...fort peu détaillé".⁴ As a consequence of this, when the project came before the Conseil-général des Ponts et Chaussées in November 1832, it was rejected.

It was evident to the Conseil that some guidance ("éclairage" was the word used) must be given if planning of such projects were to be done thoroughly and realistically. In April 1833 the government of Marshall Soult requested and received from parliament a grant of 500,000 F to undertake a detailed study of the main lines of a national railway network. This was a deliberate policy designed to remove the chief difficulties faced by companies planning railways, which said Thiers,⁵ the Minister of Commerce and Public Works, "partout en France, en empêchent souvent, et en retardent toujours l'exécution. Ce qui rend difficile l'entreprise des chemins de fer," he continued, "c'est la dépense des études préparatoires, le délai sous la vérification de ces études, et la longueur des enquêtes préalables. Ces études sont fort coûteuses." Already in September 1832, shortly before Legrand had been appointed to replace Bérard as Directeur-général des Ponts et Chaussées, a small commission of engineers had been appointed to prepare plans for six main lines out of Paris to Rouen and LeHavre, Lille,

Strasbourg, Marseille via Lyon, Bordeaux and Nantes,⁶ and once adequate funds had been assured by the grant of 500,000 F, engineers were appointed to study specific railway lines. At the same time others were sent to see the most recent developments in Great Britain and America,⁷ and experiments were begun on important technical problems.⁸ Thiers allowed Mellet, Henry, Ruolz and their rivals Ardoin, Noblot et Cie to submit further plans in February 1834, but once again, and for the same reasons, they were turned away.⁹ In its session of 12 April 1834 the Conseil-général des Ponts et Chaussées decided to consider no more railway projects until its own surveys and cost estimates had been completed. These were carried on actively between Paris and LeHavre through the summer of 1834 under the direction of two engineers, Mallet and Defontaine, and the report they submitted contained the first realistic appraisal of the line's probable cost. Defontaine's estimate was about 220,000 F per kilometre, or thirty million francs for the 137 kilometres of line to Rouen; a line the whole distance to LeHavre, plus necessary branch lines, he estimated would cost over sixty million francs.¹⁰ Although this was still much lower than the final real cost, it was an estimate upon which serious discussion could begin.

A very important issue with both economic and political implications which had not yet been explored in any depth was the extent to which the State would become involved in construction and finance of railways. It was thought very improbable that the State would assume the predominant role in this field which it had assumed with respect to waterways. In introducing the bill later known as the Grande Loi des Travaux Publics at the end of April 1833, the Minister stated that it was not his intention to "tracer des chemins de fer aux dépens de l'Etat; non, Messieurs," he told the deputies, "une telle pensée ne saurait entrer ni dans votre esprit, ni dans le nôtre."¹¹ During the 1820s every line of railway authorized in France — only three eventually totalling 137 kilometres, all serving metallurgical industries in the upper Loire — had been built by private companies. Now that they were likely to be of more general use and require much larger investments, the question might well be asked whether this could continue. There were

some people, especially the Saint Simonians, who would have preferred to see the State assume complete charge of railways as well as waterways; such a policy they believed would avoid the evils of speculation and competition and would allow coherent planning and construction of a national network. Their hostility to private enterprise entering this field is clearly evident in an important book written in 1831 by four young engineers, Lamé, Clapeyron, and Eugène and Stéphane Flachet.¹² They wrote with obvious distaste of the "spéculateurs qui vivent et agiotent sur les projets colportés par eux aux capitalistes" However, the government, in view of its already large commitments to improvement of waterways and roads, was unwilling to involve the State in what would probably be very large expenditures on railways. Expenditure by the State on the canals begun in 1821 and 1822 had already reached 28 MF up to the end of 1832, and this was raised to 90 MF in 1833; these amounts were in addition to the 130 MF borrowed when the canals were begun. In the same year more than 20 MF were committed to special road projects.

The governments of the July Monarchy, with much encouragement from Legrand, were nevertheless very active promoters of improvement in transport. In 1835 the first stage of a very extensive programme to improve the nation's waterways was begun, and at the same time the first steps were taken to encourage construction of railways.¹³ It had become apparent to the government once the first studies by Defontaine and others elsewhere in the country were completed that the task of building railways would be far beyond the resources of private companies. Though it did not wish to take upon itself any responsibility for their financing, it was obvious that if any lines were to be completed even within the present decade, some means must be found to encourage and assist private capital wishing to undertake them. Not willing merely to await events, the government of the duc de Broglie decided to proceed with concession of one key line of railway, the line from Paris to LeHavre and Dieppe. This was the line most desired by transport users, said Thiers, who was still Minister of Public Works, and though it was the shortest of the so-called 'grandes lignes', it would join Paris with Rouen, one of the country's most important towns, and with London. This first venture, he continued, would test the strength of railway companies and the merits of various methods of assisting and

controlling them. One form of assistance suggested by many, the guarantee of interest, was rejected by Thiers as too unpredictable and potentially too large a financial burden upon the State. The method he proposed was taken from experience in America, where the State had often assumed part ownership in railway companies. Specifically the government proposed to award a 99-year concession to a company chosen by open competition, and would then purchase one-fifth of the company's equity capital. The route proposed by Thiers was the one recommended by Defontaine, crossing the plateau to LeHavre and Dieppe via St.-Denis and Gisors, with branch lines to Rouen and Pontoise.

Choosing a Route from Paris to LeHavre, 1835 to 1837.

Before a concession could be granted there was a lengthy process of consultation, official deliberation and legislation to be completed. It is likely that Thiers hoped to have legislation passed in the session of 1835 that would allow him to complete the other stages during 1836. His projet de loi however, was never even voted upon, for the commission of the Chambre of Deputies nominated to examine it immediately found itself confronted by the question of which route the railway should follow. Being unable to answer this question, the commission could recommend only that it receive further study. About one thing there was no doubt, that the government would make the final choice, though it would listen first to the advice given in public inquiries and to the recommendation made by the Conseil-général des Ponts et Chaussées. As for the route from LeHavre to Paris, it had seemed best in the general interest, said Thiers, to "aller à la mer par la ligne la plus courte,...avec embranchements commodes sur les points importants"¹⁴ Unfortunately the only company prepared then to finance and build the line was opposed to this route. The Cie Riant, which had taken over documents and some financial backing from the former Cie Ardoin et Noblot, stated to the parliamentary commission late in April 1835 that it would only agree to build a line if it went through the valley of the Seine, passing directly through Rouen. Just a month earlier Jacques Laffitte, one of Riant's backers, had written to Thiers urging him to accept this route, pointing out the larger potential traffic from

the many cities and towns in the valley.¹⁵ Mellet, Henry et Ruolz had proposed to build their line by way of the plateau, and at an inquiry held in Rouen in 1832, there had been several objections to it, that it would involve a long and steep approach to Rouen and its quays, and that the numerous valleys to cross along the route would require too many cutting, tunnels and viaducts. It had been suggested then that a valley route be carefully surveyed before granting any concession, and at the urging probably of Barbet, Mayor of Rouen and one of its members, the parliamentary commission recommended once more that the Ponts et Chaussées undertake such a survey.

There is no doubt that by 1836 local opinion still favoured the valley route. Riant et Cie submitted their first complete project in January 1836, and public inquiries were held that summer in the four departments crossed by the railway line, the Seine, Seine-et-Oise, Eure and Seine-Inférieure. All but one of the representative bodies consulted stated a preference for the valley route. Their reasons for this were best expressed by the Chambre consultative des Arts et Manufactures of Yvetôt, a small textile town between Rouen and LeHavre. "Il importe beaucoup", said its submission to the inquiry at Rouen,¹⁶

de choisir une direction qui soit de nature à favoriser le plus grand nombre d'intérêts et à exercer une heureuse influence sur le commerce, l'agriculture et l'industrie, en satisfaisant à la fois aux conditions de célérité, de sécurité et d'économie dans les relations non seulement de Paris à la mer, mais aussi des villes populeuses et commerçantes.

Two Ponts et Chaussées engineers, Polonceau and Bélanger, had been engaged by the company during the previous summer, and they had done a detailed survey over the whole route from Paris to LeHavre. Their plans included not only a line passing through Rouen, but also branch lines to the important towns of Elbeuf, Louviers and Evreux. Their estimate of the cost of this line was 74 MF (the first estimate of Defontaine had been 60 MF), and Riant offered in order to strengthen his case to forgo any financial assistance from the State.¹⁷ Only LeHavre expressed any misgivings about the valley route, but agreed not to oppose Riant since his project had the obvious advantage of serving more communities, and apparently required no subsidy.¹⁸

LeHavre's misgivings had been prompted by information received from the Directeur-général des Ponts et Chaussées, for when consulted by the Minister in October 1835, the Chambre of Commerce in LeHavre had expressed no preference for either route.¹⁹ It had been Defontaine's conclusion after his own surveys in 1834 that the valley route was quite unsatisfactory owing to "difficultés presque insurmontables" which would make it impossibly costly to extend the line beyond Rouen, and so to serve LeHavre. He had recommended therefore that the line not be brought down to river level, but taken along the plateau and brought to Rouen only by way of a branch line. Early in 1836 Legrand warned a delegation from the municipal council in LeHavre that a line passing through Rouen by way of the valley would be very difficult and costly to extend to LeHavre.²⁰ The delegation, which was invited by Legrand to visit him in his office in Paris, were told of his surprise at the small amount of interest being shown in LeHavre in the railway question, especially by the Chambre of Commerce. Legrand told them that his engineers had serious doubts about the accuracy of the surveys done by Polonceau and Bélanger. The delegates promised to take these warnings back to LeHavre, with the result that both the Chambre of Commerce and the city council wrote to Legrand²¹ asking him to ensure that their interests were adequately protected. Then two months later in May 1836 M. Bouchon, a representative of Riant et Cie, was invited to address a meeting of the Chambre of Commerce. When he formally committed the company to immediate extension of its line to LeHavre, the Chambre's fears were somewhat allayed, and they agreed to indicate tentative approval of the valley route at the forthcoming public inquiries.²²

Although this might have been the end of the argument, with a concession being awarded shortly to Riant et Cie, it was not. Defontaine was determined that the plateau route should receive a further hearing. He and Mallet had done a brief examination of a possible valley route, as requested by the parliamentary commission, and had concluded that it was not economically feasible. Then following the public inquiry they had also decided to revise their plans for the plateau route, in such a way as to satisfy most of the objections to it, especially those of Rouen. They redesigned the route so that

the main line passed through Rouen (as is shown on the map in Figure 9), though the station remained a considerable distance from the quayside. With this in hand the Minister, now Hippolyte Passy, decided to order a new round of public inquiries to begin in October 1836.

Defontaine appeared before the commission of inquiry in Rouen and very ably defended the route he had proposed.²³ First, he said, the argument that there were more and larger towns in the valley was incorrect. There were few such centres along the valley route, and they were not industrial, whereas on the plateau there were several, the many small industrial towns and villages in the valleys running down to the Seine. All they needed was better communications to "arriver à un haut degré de prospérité".²⁴ Elbeuf and the wool towns of the Eure, Evreux and Louviers, could easily be served by branch lines. The plateau line, Defontaine argued, would be straighter and shorter, and be more easily extended to LeHavre. For these reasons it would be better able to serve the 'transit' trade. There was sharp rivalry among the main ports of northwestern Europe to attract the trade in raw materials, especially cotton, going to supply the industries of south Germany, Switzerland and central Europe. LeHavre was concerned that as railways were built to serve its rivals, and especially those near the mouths of the Rhine, Antwerp and Amsterdam, its traditional and valuable trade with the Americas would be damaged. According to M. Devilliers, an inspecteur-divisionnaire des ponts et chaussées consulted by Legrand, this must be "la question dominante" in the choice of routes.²⁵ This argument however, naturally found little support in Rouen, whose share in the transit trade was negligible. Even for LeHavre, Polonceau pointed out,²⁶ the transit trade was still "à créer pour la major partie", amounting to less than two per cent of its total foreign and colonial trade. Few in Rouen moreover agreed that in order to serve the future transit trade, it was necessary to build a railway across the plateau, which would not properly serve Rouen.²⁷ Defontaine partially redesigned his route to meet these objections, but this concession did little to satisfy his critics.

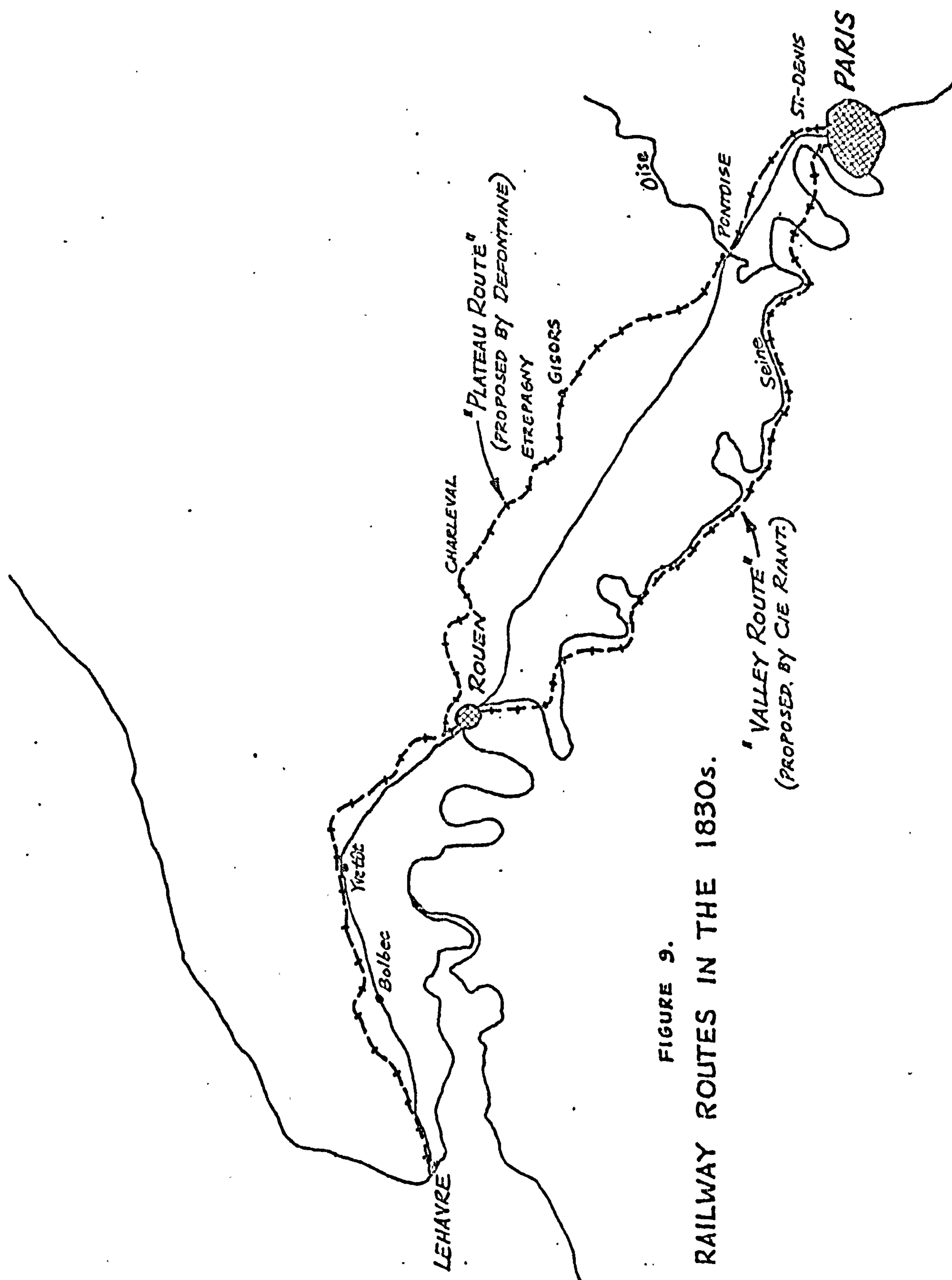


FIGURE 9.

RAILWAY ROUTES IN THE 1830s.

One argument used by Defontaine provoked great interest in Rouen and had important implications for the future. Rouen's needs, he said, were well served by the river, and it would be uneconomic to build a railway through the valley which would compete directly with river-borne transport. This was especially so, he continued, as the Administration intended shortly to begin large improvements to the lower Seine.²⁸ As he spoke the Conseil-général des Ponts et Chaussées was in fact considering means by which this might be done. Going far beyond what was proper in his position, Defontaine stated to the commission of inquiry that

ces intentions sont tellement formelles, que, dès le commencement de la session prochaine un projet de loi sera proposé aux chambres pour que 20 millions soient appliqués à l'amélioration de la Seine.

This statement was very soon repudiated by Legrand, who added that not only had the Administration as yet determined no final preference for either route, but also its choice in this matter would not be influenced by any plans to improve water-borne transport.²⁹ It had long been believed, and was still believed, that railways and waterways would complement rather than compete with each other. It was the view of both the government and the Cie Riant that the railway would carry principally passengers and the sorts of light-weight costly goods imported from the colonies and the Americas and presently carried by roulage; all other goods, which were the great majority, would continue to be carried by water.

Defontaine's arguments were persuasive, for despite Rouen's continued hostility to the plateau route, the commission of inquiry for the Seine-Inférieure, sitting at Rouen, voted ten to three in its favour.³⁰ This was not unexpected, as most of its members came from towns which would benefit most from a plateau route. LeHavre became convinced from this time on that only by construction of the plateau route could its interests be protected. Inquiries in the other departments also largely favoured the plateau.³¹ With this result Defontaine and Mallet were in a strong position to present their project to the Conseil-général des Ponts et Chaussées in the first months of 1837. Even there Defontaine continued actively to argue the advantages of his route. Both in a letter sent to Legrand early

in January,³² and in several personal appearances before the Conseil-général he argued very persuasively in favour of his route and against that of Polonceau and Bélanger. The Conseil-général concluded however, that they were of equal technical merit,³³ and after prompting from Legrand, who chaired its meetings, focused its attention upon the economic issue: which route would most economically and best serve the needs of Paris, LeHavre and Rouen?³⁴ Its final decision on the 16th of March, after debating the matter during seven sessions, was to recommend the plateau route. Riant et Cie had asked to be informed of the course of the Conseil's debates, and it requested that Defontaine not be admitted to the Conseil unless it were also given a chance at the same time to defend its project. These requests were both denied,³⁵ though the company was given opportunities during two sessions to appear before the Conseil.

The Parliamentary Stage and the Emergence of Open Rivalry Between LeHavre and Rouen, 1837 and 1838

With the routes question apparently answered, within only three weeks, at the beginning of May 1837, Martin (du Nord) the new Minister of Public Works presented to the Chambre of Deputies a projet de loi for a railway from Paris to Rouen.³⁶ This was only one of ten such proposed railway lines in a large and ambitious programme of railway and waterway development initiated by the new Molé Ministry. It was hoped that private companies would come forward to build most of the seven main lines amongst these, and in order to encourage this the government offered them liberal terms. As for the Paris-to-Rouen, Martin proposed that parliament contribute a grant of seven million francs toward the total estimated cost of 38 MF; moreover, not only need the line be built only as far as Rouen in this first stage, but the government would leave the choice of route open to the companies. The Conseil-général des Ponts et Chaussées had of course made nothing more than a recommendation.

This was a bold and sensible beginning. The government had resisted pressure from local interests to require that the line be built at once all the way to LeHavre. Shortly before the bill was presented, the Chambre of Commerce in LeHavre had written to the Minister reminding him that building the railway at first only to Rouen could result in almost indefinite postponement of the more difficult and financially more risky section to LeHavre.³⁷ This fear was confirmed, they wrote, by

information they had received that much of the capital subscribed for Riant et Cie had come from Great Britain on the express condition that the railway be built only as far as Rouen. In reply to this, Legrand wrote to the Chambre of Commerce that for practical financial reasons the government could not insist that the entire line be built at this time, but that between the present parliamentary session and the next the Administration would try to find means for financing the second stage.³⁸ Two days later Riant et Cie wrote to the Minister accepting the cahier des charges annexed to the bill, but refusing the financial assistance it offered; however, it also suggested that a way might be found for both sections of the line on either side of Rouen to be built simultaneously.³⁹ This suggestion indicated that such a project was possible, and with this in hand a commission of the Chambre of Deputies very soon recommended that the government's project be extended immediately to Le Havre and Dieppe.⁴⁰ The government accepted this recommendation and on the 3rd of June Martin submitted a new projet de loi for the whole line to Le Havre, this time offering a subvention of ten million francs.⁴¹

Over the next two weeks, events worked just as quickly to reverse this result. The new projet de loi was sent back to the same commission, and when a week later it reported to the Chambre,⁴² it reversed its first recommendation. Railways, stated the rapporteur, would be enormously costly to build, and especially in France where iron and coal were so dear.⁴³ For this reason they must be built only where there would be dense flows of passenger traffic. A line from Paris to Rouen was likely to carry a large passenger traffic and to be very profitable, as was indicated by Riant's offer to build it without subvention; the lines to Le Havre and Dieppe would not, and a subvention of only ten million francs was unlikely to be sufficient to attract any company to build them. The commission therefore recommended that the Chambre reject the second bill and pass the bill first submitted by the government. Though Le Havre was disappointed, this result had not been unexpected by the Chambre of Commerce.⁴⁴ Nor however, was even this minimum bill passed into law. The short time remaining in the parliamentary session was taken up with a debate on the general principles which should govern railway development.⁴⁵

During this general debate it was seriously suggested that the State should assume the entire financial responsibility for railways, and it became apparent that opinion in the Chambre seemed now to favour such a course of action. It was feared that the private sector of the economy would be incapable of providing the huge sums needed.⁴⁶ Riant seems to have been compelled to obtain about half the subscriptions for his company in Great Britain.⁴⁷ There had been a small railway 'boom' since April when the first Paris-to-Versailles railway had been launched,⁴⁸ and during 1837 there are said to have been 38 MF committed to railway construction, compared with a total amount invested in railways up to that time of only 31 MF.⁴⁹ As shares in several companies found their way onto the Bourse however, there were rumours of considerable speculation, and fears were expressed both in the Chambres⁵⁰ and in the press⁵¹ that further speculation would precipitate a financial crash. Etatist political ideas seem also to have had a role in this change of opinion. Both roads and waterways had since 1830 become the exclusive responsibility of the State; Belgium had its State railways system. Count Jaubert received an enthusiastic response in the Chambre when he stated⁵² that it was

les principes de la centralisation qui font la gloire et la puissance de la France; je ne le cache pas, je tiens...sur ce point aux doctrines de l'Empire; j'y ai été élevé! Mon rêve serait de concilier la puissante et bonne administration de l'Empire avec les formes et les garanties de la monarchie constitutionnelle.... La centralisation...doit être fortifiée plus que jamais: en voici une grande occasion.

New legislation was introduced in 1838. The government was determined on success, and strengthened by the results of an election in November 1837, it tried to satisfy the main objections and suggestions voiced in the previous year's debate. On the 15th of February 1838 Martin, who remained Minister of Public Works in the second Molé Ministry, presented a group of projets de loi for several railway lines.⁵³ Instead of the piece-meal approach, which had been strongly criticized in 1837, he now presented them as part of a national plan for transport, embracing both waterways and railways, and taking into account the economic functions of both. To provide for the two principal functions of railways, transport of passengers and of costly goods including those in the transit trade, the Minister outlined

a system of nine main lines mostly radiating from Paris, one of them to LeHavre. However, to avoid excessive strain on the economy and the nation's finances, he said, the network of railways must be built gradually and integrated in the most efficient way possible with the existing and planned waterways. From Rouen to LeHavre, he continued, "la navigation à la vapeur peut jusqu'à un certain point, et pendant quelques tems du moins, suppléer les voies de fer." Reverting therefore to the original plan of the year before, he proposed once again that only the line from Paris to Rouen be built first, but in such a way as to ensure that it could be easily extended to LeHavre.

The Minister also proposed that the State should take full responsibility for finance and construction of the main lines of railway. This, he said, would ensure rational development and permit the State to set uniform and low rates of carriage. There was great dissatisfaction at this time with the high rates being charged by the companies given canal concessions in 1821 and 1822. Following the elections in November 1837 the government had set up an extra-parliamentary commission to study this and other questions, and it had advised that the State assume the main responsibility for railway development.⁵⁴ The main reason for this recommendation was the fear of speculation, and even corruption, which one of its members pointed out had occurred in Great Britain. This change in government policy was welcomed in LeHavre, since it was believed there that only if the State undertook to build railways would one be built over the plateau; even though the government had stated that it could not immediately build a line from Rouen to LeHavre, State construction nevertheless offered the best guarantee of an eventual extension. On the other hand, with the Cie Riant in existence, Rouen naturally favoured construction by a private company, as this would ensure a railway through the valley.

LeHavre's Successful Campaign for a Railway by the Plateau.

Martin's new bill was the signal to begin six months of intensive political activity. The bill had satisfied no one, and the government and the unusual eighteen-member commission des finances nominated by the Chambre to examine it⁵⁵ were beset on all sides by petitions and delegations. They came to Paris from LeHavre, from Rouen and from Dieppe, while the represen-

tatives of the Cie Riant had been in Paris for some years. The delegation from LeHavre provides a very interesting study of local initiative and political action in support of a railway project. Through correspondence preserved in the Chambre of Commerce in LeHavre, their activities can be followed quite closely.⁵⁶

LeHavre's efforts were fairly intelligently conducted, though some credit for their eventual success in overcoming a very weak position must go to their colleagues from Dieppe. To co-ordinate their actions the Chambre of Commerce and the Municipal Council in LeHavre had formed in December 1837 a joint railway committee or commission mixte.⁵⁷ Its task was to devise a strategy to obtain a railway as soon as possible all the way from Paris to LeHavre. There was a choice of three alternatives to the government's plan. They could try to persuade the government to extend the line all the way to LeHavre in a single stage, or they could encourage the formation of a new company to build all or part of a line along the plateau. Or, finally they could fall back upon the long-standing offer from Riant et Cie. The committee favoured the first alternative, and it would have been ideal. However, they were forced also to devote considerable effort to the second. For some time there seemed to be a good chance of persuading the government to amend its projet de loi; LeHavre was an important transit port, and there had been general agreement in the extra-parliamentary commission during November when Legrand stated that the line should be built all the way to LeHavre. The tendency of opinion in the Chambre of Deputies seems ironically however, to have changed since the previous summer, and information at LeHavre was that most deputies now favoured giving responsibility for railways to private enterprise.⁵⁸ It was possible then that the Chambres would vote this way; to cover this possibility, which was considered strong, LeHavre's strategists had also actively to pursue the second and third of their alternatives. Whatever the outcome, they wanted to ensure that any line built should be by the plateau, and be built all the way to LeHavre.

To execute its strategy in Paris, the committee nominated a delegation of three, Pierre Frissard, ingénieur-en-chef des ponts et chaussées and directeur du port at LeHavre, Antoine

LeMaistre, former deputy and present mayor of LeHavre, and Reilly, president of the Chambre of Commerce. Their first task was to deliver a petition to the commission de finances. Just two days after its appointment, Mermillod, one of the deputies from LeHavre, wrote to his constituents urging them to send a petition; it must stress the vital issues, he wrote, those emphasized by the Minister, the importance of the transit trade and the problems involved in building only as far as Rouen in the first stage.⁵⁹ The petition was quickly circulated in LeHavre, and was apparently well-received by the commission. This done, the delegates then spent six tiring weeks in Paris, speaking to deputies, to members of the commission, to the Minister, to bankers and journalists, and waiting to be heard by the commission. Upon arrival the three delegates met with Bérigny and Mermillod, their two deputies, and it was agreed that Bérigny would propose an amendment to the projet de loi that the State be left to build only the three most important trunk lines, from LeHavre to Strasbourg, from Lille to Marseille, and from Paris to Bordeaux; the remaining smaller lines would be given to the companies.⁶⁰ Then they took their arguments out into the corridors of the Chambres, where LeMaistre still had many friends. They spoke with comte Molè, head of the government, and several other deputies. In this way they were able to meet and confront the deputies from Rouen, MM Curmer and Henry Barbet. Barbet, remarked Frissard, seemed to have a very feeble grasp of the facts and issues involved. Taking their turn in the procession of many delegation, they also visited the Minister, and were well-received.⁶¹ The delegates also had other means at their disposal for reaching the deputies. On the 8th of March they had published in a weekly business newspaper, L'Europe industrielle, a special article setting forth their arguments for a plateau route and continuation to LeHavre. The cost of printing one's own pamphlets, which anyway had to compete with a thousand others for the attention of the deputies, was not inconsiderable, so that contacts with the press were a valuable asset. The journals of course were not just looking for good copy; the editors, wrote Frissard,⁶² have and will write "tout ce que nous leur proposeraient sans aucune subvention et dans le seul espoir d'introduire leur journal dans un localité important comme LeHavre."

While the commission des finances slowly conducted its hearings, the delegates also explored their other alternatives. A decision in favour of State execution was by no means certain, and they had confirmed immediately upon their arrival in Paris that opinion amongst the deputies seemed to be in favour of the companies. The reason was apparently financial; as Frissard remarked, opinion "redoute de voir le gouvernement s'engager dans d'aussi grandes dépenses".⁶³ It had already been carefully considered in LeHavre whether the city should turn to the Cie Riant. Riant et Cie had offered to build their line all the way to LeHavre, and the company seemed to have adequate financial backing; this alternative, if successful, would be an easy way out. However, the committee in LeHavre was suspicious of Riant, as the Chambre of Commerce had always been, and for the same reasons. They decided that Riant must be dealt with very carefully, and they instructed the delegates to Paris to "agir avec réserve", to make no commitments and to press the company for a full explanation of its position.⁶⁴ Riant et Cie had remained very active since failing to obtain any concession the year before, and were also lobbying in Paris, with the support of a delegation from the Chambre of Commerce in Rouen. They had tried again in January before the opening of parliament to obtain concession of the railway. After the introduction of the new projet de loi they broadened their approach and tried directly to enlist the support of LeHavre. First they had approached the three delegates to Paris, who were waylaid while travelling from LeHavre. Arriving in Rouen at midnight, they were met by M. Bouchon, whom Frissard described a little mockingly, but justly, as the "infatigable, l'intrepide M. Bouchon, le plus zélé procureur et agent de la Compagnie Riant".⁶⁵ For twelve hours the delegates held M. Bouchon at bay, giving nothing, and accepting nothing from the company. They spelled each other off every hour or so, while M. Bouchon neither ate nor slept. The delegates were met again in Paris, and the company offered them a kind of alliance; Riant promised that every possible guarantee would be given, that the cahier des charges might even be drafted in co-operation with the delegates. Very soon afterwards, on the 20th of February, Riant and two of his associates wrote to the Chambre of Commerce in LeHavre once more outlining and defending their

proposals. The technical feasibility of the line, they wrote, could certainly no longer be disputed, and they promised to build it in one stage all the way to LeHavre. Financial arrangements were well in hand owing to the success of a capital subscription recently opened at the offices of Jacques Laffitte.⁶⁶ The Chambre of Commerce does not seem to have replied, and remained sceptical that the company would fulfill its promises. Nevertheless Riant's offer was not refused outright, for as Frissard recommended,⁶⁷ "c'est une planche de salut que nous devons conserver avec soin," and relations with the company and its representatives always remained cordial.

What LeHavre's strategists wanted most was a viable alternative to Raint et Cie, a company which, they said, would 'neutralize' Riant. For this purpose the delegates were authorized by the committee to make contacts with bankers and other potential sources of financial support for a company, and while making no promises on behalf of LeHavre, attempt to start a stock subscription. For at least a month they appear to have made no progress in this direction. Then during the second week of March they wrote to LeHavre indicating that two contacts had been made, the first with agents or acquaintances of John Cockerill, textile mill, foundry and mine owner of Liège, and the second with James de Rothschild. The delegates were optimistic of success, and meetings were planned with both Cockerill and Rothschild during the third week of March. Their optimism however, was short-lived, as Cockerill failed to arrive in Paris when expected,⁶⁸ and Rothschild gave them no encouragement. Rothschild was probably very wary of any commitment to a Paris-to-LeHavre railway. During January he had been advised by a friend, J.-C. Davillier, not to become involved in Riant's project, owing to evidence that that company's cost estimates were far from accurate;⁶⁹ now he told the delegates that before committing himself to participation in their company, for the plateau he would wait for a decision from the parliamentary commission.⁷⁰

The delegates were disappointed of course, but quickly turned to search for other means. What they thought was needed was a group of capital subscribers and the backing of the largest bank which could be found in Paris. Then, wrote Frissard,⁷¹

on aura des souscripteurs en masse.; Je crois même que tous

ceux de la vallée soumissionneront les plateaux. Mais en ce moment il convient de neutraliser la souscription de la vallée par une autre sur les plateaux et c'est chose très possible.

On the 18th of March Frissard had an interview with the editors of L'Europe industrielle, and worked out an arrangement whereby one of them, M. Lubis, would help the delegates to find subscribers and a banker. The banker-financier he had in mind was still Cockerill. Frissard wanted to go right ahead with this plan, but LeMaistre, more cautious, thought it best that the subscription not be opened until after the commission des finances had come to a decision. He also suggested that the delegates ask for approval from the committee in LeHavre before proceeding with any plan. Frissard felt his initiative was being unnecessarily frustrated; "Je ne partage pas cette opinion," he wrote, to his colleagues in LeHavre.⁷²

parceque je pense qu'il serait préférable de présenter dès à présent la ligne des plateaux avec une souscription et une compagnie à l'appui. Je ne puis à moi seul former une majorité. Je m'abstiens donc de toutes démarches.

The committee in LeHavre was very slow in replying to the delegates' letters, which caused them considerable annoyance and delay. Again Frissard the activist was frustrated; he could not conceive of a mandate so limited, and he asserted,⁷³

je crois que dans une pareille affaire des délégués doivent avoir plus de latitude, car il n'est pas de position de plus facheuse que celle de ne pouvoir faire et de ne pas voir faire.

While the delegates from LeHavre waited for instructions from their committee however, the delegates from Dieppe were acting.

The Dieppois had made what was to be a major find, a banker of some consequence, Delamarre of Delamarre, Martin, Didier, a Regent of the Banque de France, who was willing to sponsor a subscription for the plateau without any particular commitments from either the Minister or the cities concerned. To determine the Government's attitude to such a company, an interview was arranged for Delamarre and the deputy Charles Bérigny with Martin the Minister and Legrand on the 25th of March.⁷⁴ Frissard was quite realistic in assessing its probable outcome; "Cette entrevue", he reported,⁷⁵ "n'aura pas de résultat bien positif, le govt ne voulant pas s'engager." But he thought Delamarre should be encouraged; "nous ferons notre possible", he wrote,

pour que Mr Delamarre ne se rebute pas de l'incertitude où l'on pourra le laisser, car l'essentiel est d'ouvrir une

souscription pour la ligne des plateaux pour neutraliser celle de la vallée, et je ne doute pas qu'elle soit bientôt accompli.

Frissard emphasized furthermore the need for immediate financial participation from LeHavre. Once again however, LeMaistre was in doubt; he could not decide how to deal with M. Lubis and M. Delamarre simultaneously, and asked for advice from LeHavre. He was less optimistic about the prospects of Delamarre; "nous ne devions peut-être pas être arrêtés," he reflected⁷⁶

par les dispositions fort douteuses encore de M. Delamarre qui n'aurait pas avec lui M. Cockerill et probablement pas d'influence dans l'opinion pour arriver seul à un prompt résultat.

LeMaistre's problem was soon solved for him by M. Lubis, who returned on the 29th to say that the conditions offered by Cockerill were unacceptable, and that the idea should be dropped. LeMaistre seems to have become deeply disappointed at this news, and came back once again to the idea that perhaps the offer from Riant should be accepted. If LeHavre waited too long all its other alternatives would be exhausted and its bargaining power reduced to nothing. Frissard also kept this in mind, and assured the committee in LeHavre that relations with Riant remained very good; but he seems to have been determined to give Delamarre a while longer to prove himself.

The vital decision however, would be made by the commission des finances, as it was likely that whatever it recommended, the Chambre would adopt. For several weeks the delegates had been seeing various members of the commission, and they hoped at last to be heard by the commission itself. But its hearing went very slowly, and the date on which they would be heard was several times postponed. "Que de patience il faut", wrote one of the delegates,⁷⁷ "...pour rester à se morfondre ainsi, ballotté de tous les vents!!" Then at the beginning of April, after hearing the testimony of the Minister and of Legrand, the commission decided that no further delegations would be heard and that it would recommend the government's bill be rejected. Although the commission's report⁷⁸ would not be tabled in the Chambre of Deputies until the end of the month, the outcome seemed certain enough to the delegates, and

they decided to return home.⁷⁹ Early in May, as expected, the entire projet de loi was defeated by the Chambre.

Many observers, including the delegates from LeHavre, believed the commission's recommendations had been politically motivated. Many of its members, like Thiers, were leading participants in the so-called "coalition" of opponents of the government. The Railway Times in Great Britain criticized the "absolute flimsiness" of the commission's report.⁸⁰ The political commentator for the Revue des Deux Mondes, a supporter of the government, suggested there had been some political collusion.⁸¹ He cited the apparent agreement to defeat the bill between Odilon Barrot and Adolphe Thiers, both opponents of the government, one of whom wanted privately financed railways, the other State railways.

Voilà qui est édifiant! Si ces messieurs mettaient seulement la moitié de cette bonne volonté à s'entendre avec le ministre, l'accord serait général et tout-à-fait touchant.... La grande question n'est pas de s'entendre pour faire des chemins de fer, mais de s'entendre pour que le ministre n'en fasse pas; voilà tout l'esprit de la ligue.

LeMaistre was of the same opinion. "Il n'était que trop évident," he said,⁸²

que nos législateurs préoccupés d'intrigues ministerielles et voulant avant tout faire prévaloir le système de coalition, qu'ils regardent comme un nouvel conseil gouvernemental, réserveraient le mérite de lois utiles aux hommes de leur prédilection, et faisant cette année le moins de bien possible pour conclure de cette manière de l'incapacité de nos ministres actuels.

However, the commission's rejection of the proposed exclusive role for the State in railway development was by then a widely supported one. The very large State involvement in public works had already been pointed out in the debate of the previous year. The total amount spent on public works (roads, navigation and irrigation projects and ports) since 1830 was almost 350 MF, and there were more than 380 MF yet to be spent on programmes underway; during 1837 more works were approved which it was estimated would eventually cost a further 470 MF.⁸³ The total ordinary budget in these years was little more than 1,000 MF.⁸⁴

Fortunately this setback in parliament was not the disaster it had been in 1837, for just as the government's bill was being rejected, the long-awaited company for the plateau had

been formed. It is not clear what had occurred during April to make this possible, but there seem to have been two companies in existence by the end of the month. The first was probably a company formed by Delamarre with the support of some local capital from Dieppe; the second probably had its origins in LeHavre, backed largely by the Banque du Havre and another local banker and member of the Chambre of Commerce, Chouquet. To prevent their resources being spread too thinly, the two groups were brought together, largely through the efforts of Pierre Frissard.⁸⁵ On the 14th and 15th of May the articles of association were signed for a single company, to be called the Compagnie Chouquet et Lebobe, after its two directeurs.⁸⁶

It was widely known that the government planned as soon as possible to present another bill for this railway line,⁸⁷ and on the 12th of May the about to be formed Cie Chouquet et Lebobe had submitted a request for its concession. Riant et Cie, with the support of a delegation from Rouen, had done the same, and it seemed to have some parliamentary support. Mermillod urged LeHavre to send its delegation once again to Paris.⁸⁸ Negotiations were opened between Chouquet, Lebobe et Cie and the Minister, and when they had been brought quickly to a conclusion a new projet de loi was introduced into the Chambre.⁸⁹ According to its terms the railway from Paris to LeHavre and Dieppe via the plateau, estimated to cost 75 MF, would be conceded directly to the Cie Chouquet et Lebobe. Construction would be completed within eight years, no competing line would be permitted for a period of 28 years, and at the end of eighty years the line and its equipment would be turned back to the State. Though there were several hours of debate on the bill, it was easily passed. The company was definitively organized as a société anonyme late in July and began its work soon after.

The Failure of Chouquet, Lebobe et Compagnie.

In July 1838 its financial foundations had seemed very strong, though within thirteen months this company had been voluntarily liquidated, having accomplished nothing. Indeed, it had been largely upon the assurance of financial strength that the government and the Chambres had agreed to the concession. Amongst the original founders of the société en commandite of 14-15 May were several eminent names from the

financial and business world: Delamarre, the duc Décazes, Boigues of Fourchambault, the comte Roy, another maître de forges, Théodore Humann, later Minister of Finance, and Aguado, the duc de las Marismas. When the société anonyme was approved in August several other names of equal stature were added to the conseil d'administration.⁹⁰ Three out of the thirteen members of the conseil are among seventeen men listed by A.-J. Tudesq⁹¹ as the wealthiest property-owners in France, and they solemnly pledged their honour to carry out the obligations entered into by the company. Collectively the members of the conseil d'administration were required by the company's statutes to own at least 20,000 of the company's 90,000 shares. Confidence in the company was further increased when comte Jaubert, known for his "capacité et la sévérité de ses principes",⁹² was appointed general manager of the company.

The railways were no longer dependant exclusively upon bankers and large individual financiers, but had begun also to receive funds from the wider investing 'public'. Ownership of the company's shares was eventually spread over a fairly wide base. The company first offered its shares to the public in the form of promesses d'actions with a par value of 1,000 F during May, and the entire 90,000 offered for sale were taken within the first day.⁹³ The total number demanded is said to have been almost 300,000.⁹⁴ The stock of Riant et Cie, which had also been sold out on its first day of issue, simultaneously suffered a fall of ten per cent on the Bourse.⁹⁵ A considerable number of the promesses issued by Chouquet et Leboe were acquired by merchant bankers⁹⁶ for later resale (at an inflated price) to smaller investors. This was a kind of speculation, and contributed to speculation by others; according to Frissard,⁹⁷ this was one of the greatest contributing causes of the company's later weakness. An even greater contributor to speculation was the requirement that each shareholder be held liable to pay up only 25 per cent of the par value of his shares; the Conseil d'Etat had wanted to impose a requirement of 100 per cent,⁹⁸ but was over-ruled by the Minister. The same provision applied to other companies being formed at this time, the Paris-to-Orléans and the Strasbourg-to-Bâle. The companies claimed, perhaps correctly, that if their shares

were to carry 100 per cent liability they could not be sold. Despite the initial large role of the bankers, by the time the société anonyme had been formed, almost half of the company's shares were owned by relatively small shareholders with fifty shares or less.⁹⁹ These were not large holdings, for although each share had a par value of 1,000 F, the holder was required initially to pay up only 100 F of this. More than eighty per cent of the shareholders owned ten shares or less, and 96 per cent owned fifty or less; the corresponding figures for Riant et Cie were 69 per cent. and 95 per cent.¹⁰⁰ Local participation was not very large. Only about three million francs subscribed by Aguado, who was a land-owner in the area. The town of Dieppe is said to have received but refused an offer from the directors of the London and Brighton Railway of a subscription of 12 MF.¹⁰¹ The amount subscribed in LeHavre is unknown; the largest known shareholder from LeHavre was the banker Chouquet, who bought 1,300 shares.¹⁰²

The company's first setback was financial. The financial depression which occurred in the latter half of 1838 and brought the short 'railway boom' to an end seriously affected the company's credit. As Bertrand Gille explains,¹⁰³ the total stock of funds available for both short and long-term credit was not sufficiently large to sustain the investment 'boom' of 1837 and 1838. The large investment in railway stocks which occurred during these years reduced the fund of credit available for commercial transactions; as the needs of commerce were reasserted, funds were withdrawn from long-term investments and the price of stocks fell. The effect of this on several of the principal railway companies is seen in Figure).¹⁰⁴ The Morning Post of London commented on the railway investment crisis in France that¹⁰⁵

The weight of the enterprise is too great for the commercial capital of France, and it is impossible that any one line can be accomplished unless the aid of foreign capital be obtained.

The most serious effect of the crisis upon Chouquet, Lebobe et Cie was not the fall in the price of its shares but its failure to obtain further payments of 100 F per share from all of its shareholders. After initial payments of only 100 F per share at the time of subscription, several further payments were

owed at regular intervals of about three months. The second payment, or versement, was due on the 10th of October 1838, and the third, for only 50 F per share, was due on the 10th of December. On the original sale of promesses the company had realized only about 8.5 MF instead of the 9 MF expected; for various reasons,¹⁰⁶ 2,548 shares had remained unsubscribed. The first call for a further 9 MF yielded only about 5.6 MF, and the second for 4.5 MF yielded less than 2 MF.¹⁰⁷ This left the company with only 16 MF instead of an expected 22.5 MF. As the financial crisis deepened through the winter, there was a declining prospect of success with calls for the remaining 67.5 MF left outstanding. Owing to the crisis moreover, provisions in the company's statutes for forcing payment of arrears were of little use. Delamarre himself, whose bank was a large holder of current accounts of small business firms, could not meet his obligations and was forced to obtain a special loan from the Banque de France to avoid bankruptcy.¹⁰⁸ By June 1839 Delamarre still owned 2,787 shares in the company, but had made no payments on any of them. At the same time Chouquet, Leboe et Cie had paid out over 167,000 F to Delamarre, Martin et Didier in bankers' fees.¹⁰⁹

Before these financial problems had become apparent the company had begun preparations to start work on the railway line. The main task of the company's directeur-général comte Jaubert was to prepare and present to the Administration every four months completed and detailed plans for the construction of sections of at least twenty kilometres of line; the entire line was to be completed within a period of no more than eight years.¹¹⁰ Attention was concentrated initially upon getting started on the first twenty-five kilometres of line between Paris and Pontoise; it was here that the greatest traffic potential existed, and it seems to have had the best and most complete plans already in existence. Negotiations were begun for the purchase of land in Paris and along the route to Pontoise, and by November about one-third of the total required had been arranged. Within Paris the company made arrangements to buy parcels of land worth over 1.5 MF. Using plans drawn up by Defontaine, work was even begun on part of the line itself. On the 15th of September 1838, in the presence of the Minister, the Directeur-général des Ponts et Chaussées, and Aguado, the

President of the company, the foundation stone for a bridge to cross the Oise at Saint-Denis was laid. On the 12th of October the company formally asked permission to begin construction between Paris and Pontoise.¹¹¹ Rolling stock had to be ordered far in advance, as owing to large demand for both rails and rolling stock by many companies in both Great Britain and France, a long period before delivery was expected. Between the middle of September and the middle of October therefore, the company placed three contracts in Great Britain for a total of fifteen locomotives and three tenders.¹¹² In October attention was also turned to making preparations to begin work on the remainder of the railway. An engineering staff had been appointed, comprising a total of twenty-seven men. The three principal engineers were Virla, in charge of the section between Paris and Rouen, Frissard of that between Rouen and LeHavre and Dieppe, and Bineau in charge of rolling stock and the permanent way.¹¹³ The Administration's plans, prepared by Defontaine in 1835 and 1836, were handed over to the company in mid-October, and at the end of the month Frissard established an office in Rouen.¹¹⁴ Using Defontaine's plans and cost estimates as an outline, he and the other engineers began preparation of a detailed project.

Within a very few weeks it became evident that Defontaine's cost estimates, and perhaps even the route to be followed, would require major revisions. This information precipitated a crisis, for in view of the difficulties which were already being experienced in obtaining funds, it became open to question whether the company could continue with its construction programme if its cost were to rise much above the estimate made by Defontaine. There were two opinions among members of the conseil d'administration. One group believed that the company had an obligation to the country to fulfill the promises made during the previous summer. It should therefore continue with the construction about to begin, and success in this would help to revive confidence in the company's future and facilitate its financing. Such a course of action moreover would demonstrate the company's good faith and help in persuading the government to extend aid or to modify its cahier des charges. The opposing view was that in the interests of the shareholders, to whom the directors were mainly responsible, it would be unwise to continue

construction until a revised cost estimate had been prepared; it might be discovered that the company had no chance of completing the line with its present capital, even if it could be realized. It would be better to liquidate the company than to build an incomplete and ruinous railway.¹¹⁵ At a meeting held by the conseil d'administration late in November 1838, it was decided that the entire line from Paris to LeHavre and Dieppe must be re-surveyed and new cost estimates prepared. In the meantime all construction on the Paris-to-Pontoise section was suspended, and a special committee nominated to prepare for discussions with the Government to obtain a change in the company's cahier des charges.¹¹⁶ At this Jaubert resigned, as he firmly believed the company should fulfill its obligation to the country and take a bolder course of action,¹¹⁷ and his place as directeur-général was taken by Lebobe. Already there were rumours in the press that the company would be dissolved, and its rivals and enemies among supporters of the old Cie Riant and the valley route were the first to point to its obvious failure.¹¹⁸

By April the company had received more detailed and reliable cost estimates, which indicated that its line would cost 135 MF, an increase of four-fifths over the 75 MF estimated by Defontaine.¹¹⁹ To restore the company to financial viability, its directors decided upon two objectives, to reduce the cost of construction and to raise the tariff. At a meeting of the conseil d'administration on the 1st of April they agreed to submit a formal request to the Administration for a change in the cahier des charges. In a letter to the Minister ten days later¹²⁰ the company asked that it be permitted to build the railway in three parts, beginning with that to Pontoise, and that it be excused from any penalties should it be unable in future to build the other sections. Secondly the company proposed that the route to Rouen be altered to cross the plateau north of the city; this would give Rouen a terminus only on the south shore at St.-Sever, and a branch connecting it with the main line. For Rouen the result would be worse than the original proposal of Defontaine in 1834, but for the company it would shorten the line by 37 kilometres. The company also asked for permission to build only one track from Rouen to LeHavre, and for a general relaxation of technical minima to allow steeper gradients, tighter curves, and more level crossings at routes

royales. With these changes it was thought that the cost of construction could be reduced to as little as 104 MF. At the end of May the company sent another letter requesting that its tariff be amended, with increases amounting to almost double for passenger fares, and a half more for goods.¹²¹ In addition to these changes, the company also asked at this time that the limit of ten per cent on its profits be removed and that it be given a guarantee of four per cent interest from the State.

Discussions with the government were delayed by a prolonged political crisis in the spring of 1839. Molé's Ministry was defeated in elections held in March and it was not until mid-May that a new government was found to take office. Once in office however, the new ministry of Marshall Soult was sympathetic toward the several railway companies in trouble at this time, and within about three weeks an agreement had been reached with Chouquet, Lebobe et Cie. On the 10th of June Dufaure, the new Minister of Public Works, went to the Chambres to ask for changes in the cahiers des charges of several companies, beginning with the Paris-to-LeHavre.¹²² To let this and other companies fail, said the Minister, would be a "désastre public", for once they were disbanded it would be very difficult to form other companies to take their places. The government proposed to relax the cahier des charges of Chouquet, Lebobe et Cie to allow it to concentrate its resources upon a smaller amount of line; its total cash resources seemed adequate to complete the section to Pontoise.¹²³ While this construction continued, said the Minister, parliament could consider during the next session what additional financial aid should be granted to this and other companies. The government also asked for authority to alter, upon request from the company, the technical minima dictated by the cahier des charges.

The response to these proposals, both inside parliament and out was largely unfavourable. A committee of the Chambre of Deputies reporting late in June¹²⁴ recommended that the government's projet de loi be rejected. The company had failed, it said, to meet any of its commitments, and the personal guarantees of its financiers had proved entirely worthless. Every reason for awarding the concession in 1838 had disappeared, the low tariff, the strong financial backing, the high technical standards, and an acceptable route. By no means therefore

should the company or the Administration now be given carte blanche to follow the cheapest route or to set its own technical standards. The committee believed that dissolution of this company would not have the effect either of seriously delaying construction of the railway, which was by no means assured by the projet de loi, or of discrediting the idea of railways financed and built by private enterprise.

This view was supported in the Chambre of Deputies, though the motives for this were not entirely disinterested. For some months the supporters of the valley route, and particularly those from Rouen, had been watching the company in its difficulties. Now they saw their opportunity to strike back, and possibly later to obtain a new concession for themselves. The most notable speeches to the Chambre were made by Victor Grandin, the member for Elbeuf, who clearly stated that he spoke on behalf of the municipal council in Rouen.¹²⁵ He attacked both the company and the Ponts et Chaussées. As for the first, capital had failed to materialize, he said, owing to the bad faith of the company's backers, who had refused to commit themselves to a liability of more than 25 per cent of their shares. The government had suggested that if the company proved unable to continue the railway beyond Pontoise, it should be purchased by the State and continued by the Ponts et Chaussées. To Grandin, and to many others, this was unacceptable; the State solution had been rejected by the Chambre in 1838, and more recent events had confirmed the correctness of that decision. As for the Ponts et Chaussées, Grandin stated that it had shown its incompetence first estimating the cost of the canals begun in the 1820s, and now in estimating the cost of railways. To pass the government's bill in the face of such incompetence, perhaps even culpability, would be to sanction "la plus grande scandale dont le pays ait encore été témoin."

Opinion in LeHavre and Dieppe was understandably mixed. They did not want to see their company dissolved, but were concerned that with the proposed changes the company would not continue its line all the way to the sea. The municipal council in LeHavre decided that it should support the projet de loi and sent the mayor to Paris once again to lobby for its acceptance.¹²⁶ The Chambre of Commerce in Dieppe took the same line.¹²⁷ However, the deputy from Dieppe, the baron de Chasseloup-Laubat,

argued that the law of 1838 should be maintained unaltered, except for some changes in technical minima and in the tariff. If the company insisted upon breaking the railway into three sections, to be built consecutively, it should lose the concession.¹²⁸ Chasseloup-Laubat was the owner of 100 shares in the company, on which 20,000 F had been paid up, and his opinion was shared by a meeting of shareholders held in LeHavre.¹²⁹

The Journal du Havre wrote early in June on the other hand that the company should be granted most of its requests, including those to divide the line into three parts. In another article on "Rouen et le Chemin de Fer" it struck back at supporters of the valley route, and at Rouen.¹³⁰ The interests of LeHavre and Rouen should be complementary it said; but instead

on voit que la ville de Rouen poursuit ses desseins, et que le désorganisation de la compagnie des plateaux, elle ne considère qu'une occasion opportune de revenir à son plan de prédilection, plan dans lequel on ne peut s'empêcher de penser qu'elle trouve à la fois deux avantages, celui de concentrer chez elle tous les bénéfices qu'elle augure d'une voie directe et exclusive de communications avec Paris, et celui plus intime d'en priver une ville qui lui fait ombrage.

A few attempts were made in the Chambre to defend the company, but the Government's bill was decisively rejected.¹³¹ With this result the company was forced to dissolve, and at a meeting of shareholders held on the 11th of August 1839, it was unanimously agreed to wind it up.¹³² According to Frissard,¹³³ the loss per share was about ten francs, but there is evidence that some of the smaller shareholders received nothing.¹³⁴

Can the company be blamed for its own failure? It was certainly responsible in large part for failure of the government's projet de loi in 1839. By deciding to suspend construction in November 1838 it had laid itself open to an attack from its rivals in Rouen. This kind of inaction and evident lack of commitment to pursue the railway project despite obstacles were very useful to its enemies and discouraging even to its friends. Other companies in the same circumstances decided on a much bolder course of action; the Paris-to-Orléans continued construction despite rising costs and failure to realize a large proportion of its capital; so did the Strasbourg-to-Bâle. Both of these companies later recovered from their difficulties and retained their concessions. The company's directors were also accused of speculation, though they denied this.¹³⁵ The company

committed other equally serious faults. The project was entered into in the summer of 1838 with insufficient care. Optimism had been unbounded, the Bourse was at its peak, and the company's backers were inexperienced. They might have obtained a higher tariff in 1838, and perhaps more liberal provisions for its amendment, but they refused them when offered. No attention seems to have been given to the question of construction costs in May and June 1838, and entire reliance was placed upon the estimates of Defontaine, by then four years old. During the debate on the company's concession in June 1838, the deputy Billault had raised serious doubts about the usefulness of these estimates, in view of the higher prices and improved technical standards which had come about during the intervening three years.¹³⁶ Cost estimates had been the most hotly debated subject in the committee of the Chambre of Peers, and the company's representatives had shown complete confidence in the ones they were then using.¹³⁷ As rapporteur for the committee of the Chambre of Deputies in 1839, Billault once again pointed all these things out.¹³⁸ The price of iron had risen considerably since 1835, rails of thirty kilogrammes per metre instead of twenty kilogrammes had become standard, locomotives had become larger, and the price of land for railways had doubled. Some of the increases in costs were owing to underestimation by Defontaine of certain quantities required. The company for example, estimated it must build 288 bridges, mostly where the line crossed roads, instead of the 195 estimated by Defontaine; the company said it would need 250 locomotives each costing 35,000 F, whereas Defontaine had estimated a requirement for only 130, costing only 25,000 F. So ended almost a decade's effort to establish a railway, the company a victim both of misfortune and its own mismanagement. Within a few months nothing more was heard of this sad affair, save complaints from the Oise boatmen about the obstruction caused by two derelict and abandoned bridge piers.

CHAPTER FIVE

A Decade of Growth and Change

While the difficult search went on for answers to the railway question, transport through the Seine valley continued to grow and to change. To say that the large increase in goods traffic or the growing demand for speed which occurred in this decade made railway development a necessity would not be true, though they certainly gave it encouragement. Relative prosperity returned to France in the second half of the decade, and from about 1837 there was a large increase in goods traffic on the Seine. Rapidly increasing use of steam power both for inland and ocean transport was at the same time a strong indication of rising demand for speed. Though there were no further innovations during this decade, those made during the 1820s were considerably expanded in scope and effectiveness, and water-borne transport on the lower Seine responded to growing demand with a rising number of tugboats, chalands and steamers. Despite this response however, the demand for speed was also reflected in a very large increase in road traffic. The development of faster water-borne transport, which might have helped to prevent this, was inhibited by the need for improvements to the Basse Seine, and in 1837 the first such improvements were begun.

The Growth of Goods Traffic during the 1830s.

Between 1833 when railways first received parliamentary attention and 1843 when the first trains ran to Rouen, goods traffic through the Seine valley to Paris increased by over half. Over the previous decade there had also been a considerable rise in traffic, amounting perhaps to as much as 100 per cent between 1820 and 1830, but this trend had been regularly punctuated by sharp peaks and troughs. This is easily seen in Figure 10 on the next page. Water-borne transport from Rouen to Paris rose to a peak of over 209,000 tons in 1830,¹ but in the ensuing economic crisis fell to only 146,000 tons in the

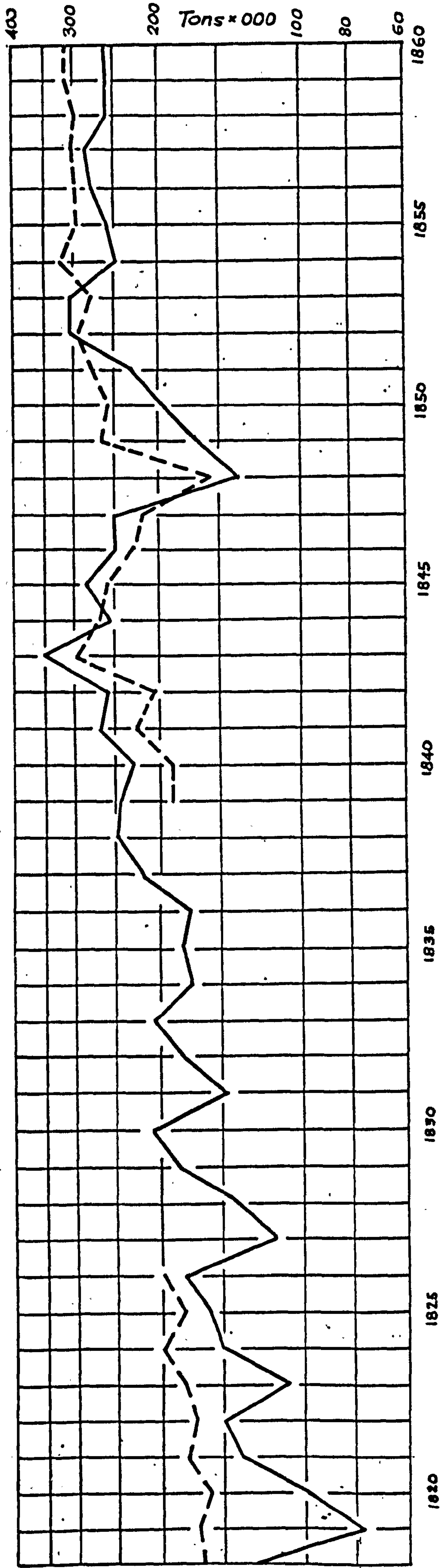


FIGURE 10

RIVERBORNE TRANSPORT ON THE BASSE SEINE

UPSTREAM ———
DOWNSTREAM - - - -

(unknown 1827-1838)

following year. After this the volume of goods traffic carried by water grew much more smoothly, without sharp peaks and troughs. After recovering quickly from the crisis in 1831, it remained for several years on the same plateau it had reached at the end of the twenties. Growth was strongly resumed in 1837, with traffic reaching a new plateau on which it remained into the mid-1840s.² Unfortunately there is too little known about road transport to describe the pattern of its growth, but it is likely to have been similar to that on the river. In 1836 the total water-borne goods traffic from Rouen to Paris was 170,600 tons; two years later in 1838 it had risen to 244,600 tons. The average annual upstream traffic in the five years before 1843 was slightly less than 250,000 tons, compared with only 180,000 tons in the five years from 1832 to 1836. The increase from one period to the next was almost forty per cent.

Fed by the same demand, the growth of ocean shipping into the ports of LeHavre and Rouen showed a similar pattern. From an inbound tonnage of about 280,000 tons in 1836,³ LeHavre's overseas trade rose to over 400,000 tons in 1838. Coasting vessels inbound to the port of Rouen rose from only 125,000 tons in 1835 to over 280,000 tons in 1838. Between 1834 and 1842, the tonnage of ships handled in the port of LeHavre approximately doubled, while that handled in the port of Rouen increased almost five times. This trend is shown in Figure 11 on the next page. Among the major ports of France this was very rapid growth; Bordeaux and Marseille for example, increased the volume of their shipping by only about fifty per cent in this period. The nature of the trade carried through the ports of Rouen and LeHavre seems to have changed in no fundamental way since the previous decade. LeHavre continued to be devoted principally to overseas trade, serving a large hinterland which included Rouen, the valley of the Seine, Paris and the north-east of France. With easy access to deep water, the average size of ships engaged in foreign trade entering her harbour was over 200 tons. Rouen remained confined to the European and domestic coasting trades, with the average size of ships coming to her port maritime still much less than 100 tons. In both ports much the greatest increase in foreign trade since the mid-1820s had come from Great Britain; at

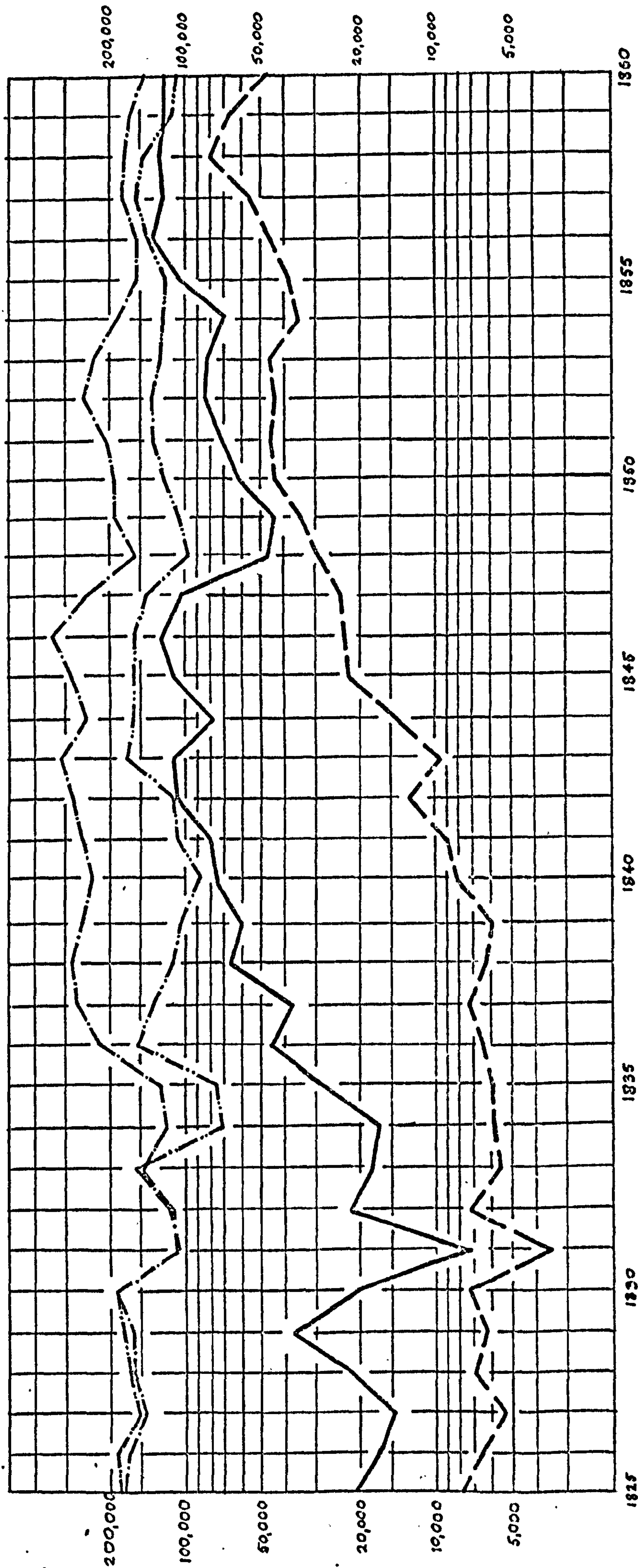


FIGURE 11 (a)
PORT OF ROUEN: SEABORNE TRANSPORT
1825 to 1860

COASTING TRADE Entering ——— Leaving —··— (Net Registered Tons)
FOREIGN TRADE Entering ——— Leaving ——— (Net Registered Tons)

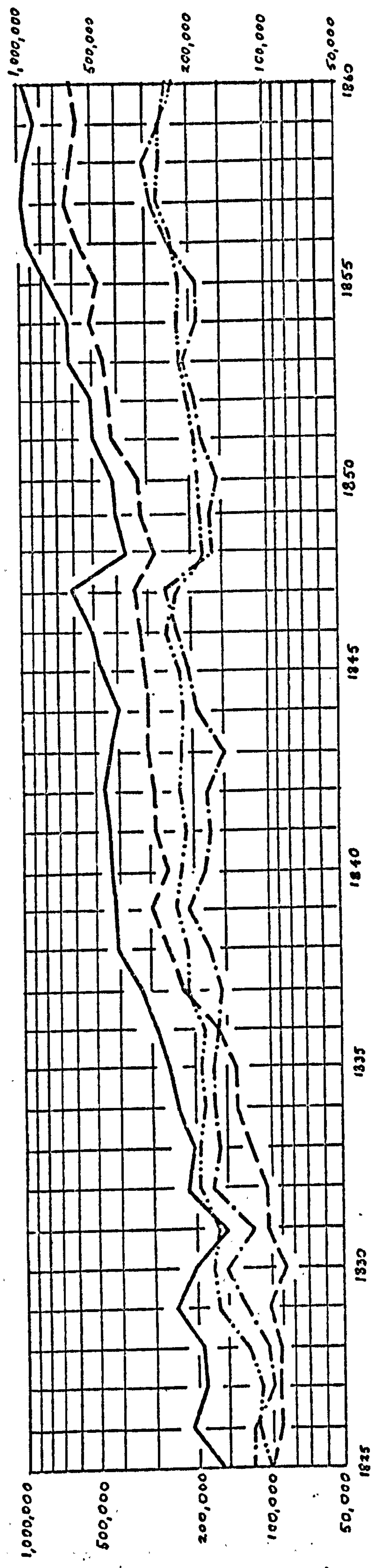


FIGURE 11 (b)
PORT OF LEHAVRE : SEABORNE TRANSPORT
1825 to 1860

COASTING TRADE	Entering	Leaving	(Net Registered Tons)
FOREIGN TRADE	Entering	Leaving	(Net Registered Tons)

LeHavre the growth in shipping from British ports between about 1825 and 1840 had been almost thirteen times, and at Rouen it was more than 26 times. At LeHavre there seems also to have been a large increase in shipping inbound from the Americas, which accounted for about forty per cent of the total in 1841.

This large growth of goods traffic reflected the return to relative prosperity which occurred in France in the later 1830s. In this period, the same which experienced the first 'railway boom', France emerged from several years of political and social crisis into a period of rapid though uneven economic growth. In the ten years from 1835 to 1844, the 'good years' of the July Monarchy, the growth rate of industrial production is estimated⁴ to have attained a record for the entire nineteenth century of 2.9 per cent, and that for the entire national economy 2.3 per cent, likewise not exceeded until the present century. During the previous ten years the average annual rate of growth by the entire economy had been two per cent, and by the industrial sector 2.8 per cent, but this had been largely concentrated in the years from 1825 to 1830.⁵ Among the most quickly expanding sectors of the economy were the textile industry, leather manufacturing, metal processing, building and construction, and food processing and consumption,⁶ and much of the river's increased traffic went to supply these. Commodities which showed large increases in volume transported during the late 1830s were construction timber and stone, metals (especially cast iron, wrought iron and zinc), skins, salt, oils and raw cotton.⁷ Some industries using these commodities were growing at rates of over four per cent per year. Among industrial raw materials cotton was perhaps the most important. Arrivals of raw cotton in LeHavre (principally from America) approximately doubled between the mid-1820s and the early 1840s, and almost 50,000 tons of raw cotton were taken from the entrepôt de douane in LeHavre during 1840.⁸ A large proportion of this went only as far as Rouen, but more than 3,500 tons were carried as far as Switzerland.⁹ Most of this went by road, but in 1840 over 3,600 tons were carried up the Seine in chalands.

Many of these goods were very costly, and there is evidence during the 1830s of increasing demand for more speedy transport. The most visible manifestation of this was a great increase in the use of steamers. The direct cost to shippers

of steam transport was generally higher than for the slower traditional means, and their willingness to pay this higher cost indicated a demand for the speed provided by steamers. Evidence of greatly increased use of road transport leads also to this conclusion. According to an article in the Journal des Economistes in 1845,¹⁰ the number of steamers registered in France grew from only 75 in 1833 to 229 in 1842. During the same period, as is shown in Table 5, the volume of goods carried by steamer in France grew almost thirty times to nearly one million tons. Of the 229 steamers registered in 1842, 68 were used exclusively for passengers, 117 carried both passengers and goods, and 44 were tugboats. At LeHavre the number of steamers registered in 1835 was eighteen, of which ten were tugboats. By 1842 the number of steamers had reached 31, of which only eleven were tugboats.¹¹ At Rouen the number of steamers registered rose from only five in 1835 to eight in 1839 and twelve in 1843.

Table 5

Steamships and Steamshipping in France, from 1833 to 1842.

<u>Year</u>	<u>Number of Steamships</u>	<u>Number of Engines</u>	<u>H.P.</u>	<u>Passengers Carried</u>	<u>Goods (tons)</u>
1833	75	90	2,635	1,038,916	38,140
1834	82	92	2,274	924,063	22,909
1835	100	118	3,863	1,588,500	121,533
1836	105	122	4,148	1,248,552	161,500
1837	124	150	5,408	2,190,621	99,353
1838	160	207	7,493	1,418,189	274,808
1839	225	300	11,297	1,969,905	213,836
1840	211	263	11,422	2,548,116	485,539
1841	227	291	11,856	2,436,627	858,986
1842	229	337	11,794	2,515,619	996,826

During the 1840s the numbers of steamers registered in these two ports remained almost constant, and began to grow again only in the early 1850s.

The Expansion of Steam-Powered River Transport.

There were no new innovations during this decade in water-borne transport, but in response to the growing demand for speed there was a considerable expansion of those made in the 1820s. The expansion of chalandage, using steam powered tugboats, was especially remarkable. Between 1830 and 1839 the number of chalands in use on the lower Seine more than doubled, from 30 to 68, and the number of tugboats grew from three to ten.¹² The first large expansion occurred early in the decade, encouraged no doubt by the large growth of traffic up to 1830. In 1831 and 1832 three new operations came into existence. The first of them was the Cie Maillet-Duboullay, which had for some years already been running the Bateaux accélérés normands. They acquired two large tugboats, the VESUVE of 100 horsepower and the HEVA of 110; they also put into operation four new chalands of 400 tons each, which because of their large size operated only between LeHavre and Rouen.¹³ The second new operation was that of Lecoq père et Cie, with one powerful tugboat, the NEPTUNE of 140 horsepower, and two large chalands of 400 tons each.¹⁴ During 1832 the Cie des Bateaux à vapeur en fer converted the old AARON MANBY to a chaland by removing its machinery, and in the following years up to 1836 acquired five more.¹⁵ In 1834 Bertin et Cie, still the largest of these companies, added ten more chalands to their existing fleet of twenty. By 1835 there were six tugboats and 42 chalands in operation on the Seine, thirty of the chalands able to operate all the way to Paris.

There was another large expansion in the number of chalands in the period of prosperity after 1836, and in addition to the existing operators, there were seven new companies formed in the late 1830s and early 1840s. These were Henry Expert et Cie, LeNormand-Baudu et Cie, Lahure et Cie, Vieillard et Cie, Lasson et Cie, Lamoisse et Cie, and the Cie Rouennaise. When the Cie des Bateaux à vapeur en fer was prematurely liquidated in 1839—it had been formed in 1827 for a period of thirty years—its four iron-hulled tugboats were taken over by two of these new companies. Henry Expert et Cie of LeHavre bought the old CASIMIR of 50 horsepower and four chalands, three of them newly built by Pierre LeMarchand at LeHavre, and the other

purchased from the Cie Maillet-Duboullay.¹⁶ The remaining three iron-hulled tugboats were bought by the new Cie LeNormand-Baudu of Rouen.¹⁷ Expert et Cie were involved simply in chalandage and tugging of sea-going ships in the Seine-Maritime. LeNormand-Baudu also had two newly constructed iron steamers which it used in the profitable passenger and goods trade between Rouen and Paris. A third newcomer, the Cie Lahure of LeHavre, used its new 100-horsepower steamer LE NATIONAL both for regular voyages to Trouville across the estuary from LeHavre, and for towing three small chalands between LeHavre and Rouen.¹⁸ Another company formed in the period, Vieillard et Cie, operated two tugboats, the HERCULE and the ALCIDE, both of 130 horsepower, between Rouen and LeHavre, and the HONFLEUR entirely within the harbour at LeHavre. By 1843 two more companies had come onto the scene, the Cie Lasson with its tugboat the QUILLEBEUF, and the Cie Lamoisse with its tug the ABONDANCE,¹⁹ but neither of these seem to have lasted for long. Of the existing companies, Bertin remained the largest, with over thirty chalands in 1845. Maillet-Duboullay and Lecoq, who merged their operations in about 1842, had between them about ten chalands and four of the most powerful tugboats.

The amount of cargo carried by chalands seems to have grown fairly quickly, though it is impossible to tell by how much, since there are no statistics which separate goods carried by this means from the total. An approximate measure of the progress made by chalandage is provided in the daily reports of departures in the Journal du Havre. The number of departures by chalands from LeHavre grew from only 66 in all of 1827 to over 400 in 1835; ten years later they had reached almost 500. This probably amounted to about two-thirds of the total traffic from LeHavre to Rouen and points beyond,²⁰ and about 35 per cent of all the traffic on the Seine-Maritime. Bertin was still much the most important operator in the mid-thirties. According to the same records, his chalands made about 300 trips from LeHavre to Paris in 1835, and carried about 50,000 tons of goods;²¹ this was somewhat less than a third of the total in that year. Beyond Rouen most of these trips were still being made with relays of horses. Early in this decade however, tugboats were used for the first time on the Basse Seine,

and strings of as many as three and four chalands pulled by one tugboat are recorded.²² Low water levels however, kept tugboats out of the Basse Seine during much of the year, and even by as late as 1846 about two-thirds of the total goods transported by water from Rouen to Paris was being pulled by horses.

Several goods and passenger steamers also plied between LeHavre and Rouen, and in the late 1830s they were joined by others on the Basse Seine. In addition to Delaistre et Cie, successor to the Cie des bateaux à vapeur en fer, which operated four ships up to 1839, two new companies began operations in 1835. One of these was the Cie des paquebots à vapeur sur la Seine (directeurs Jallant and Vieillard), with a capital of 600,000 F. They operated two steamers, the SEINE and the NORMANDIE, the latter a large vessel of 120 horsepower and over 190 tons.²³ The other newcomer was the Compagnie Pauwels, an outgrowth of a Paris steamship-building firm which built for itself two ships, the PETITE EMMA and the LOUIS PHILIPPE.²⁴ These four new steamers were primarily passenger vessels, each capable of accommodating 100 passengers or more, but they also carried considerable amounts of cargo. The NORMANDIE for example carried about 2,600 tons during the first six months of 1835, and in 1844 it and the SEINE are reported to have carried a total of almost 46,000 tons between LeHavre and Rouen.²⁵ Beginning late in the decade the Cie Pauwels also operated two goods-carrying steamers between Rouen and Paris. These were the INDUSTRIE and the PILOTE, both of only 40 horsepower and fairly small capacity; with a draught of only 1m.20 when fully loaded they were able to operate on the Basse Seine during most of the year.²⁶ In 1839 the newly formed Cie LeNormand-Baudu began operation of the first of its three DORADES, shallow-draught vessels which carried both passengers and goods. Within only a few months these were joined by the first of two rivals, the ETOILES; the identity of the company which operated them is not known. Both ETOILES and DORADES had daily departures from the end of the Paris-to-St.-Germain railway at Pecq to Rouen; stopping at nine places along the way, they were able to do the journey to Rouen in ten or eleven hours, and back to Paris in twelve or thirteen.²⁷ The amount of goods they carried is unknown, though owing to their size and their primary role

in carrying passengers, it is unlikely to have been large. According to Charles Minard,²⁸ ingénieur-en-chef des ponts et chaussées, about 70 per cent of the goods carried travelled only a small portion of the way between Rouen and Paris, and seem therefore to have been mainly messageries. Another steamer, the VAUBAN, owned by the Cie Pilté frères of Rouen, also operated between Rouen and Paris during these years, but its career seems to have been a short one.²⁹

An important development during this decade was the development of direct water-borne transport between LeHavre and Paris. Almost all the goods shipped direct were carried in chalands, and many of them were pulled by tugboats on the Basse Seine. Unfortunately once more, owing to lack of adequate statistics it is impossible to determine the amounts of goods involved. A considerable obstacle to this kind of operation was eliminated in 1835 when the old Pont des Bateaux at Rouen was replaced; it had separated the port fluviale from the port maritime and was opened for the passage of river boats only twice daily.³⁰ In 1834 the operators of chalands had also been relieved of the requirement that their boats be inspected on every passage through Rouen; in that year the Minister of the Interior established a second commission d'inspection des navires at LeHavre.³¹ There is no doubt that the impetus behind development of direct transport on the lower Seine was a rising demand for greater speed. One of the commodities most frequently carried from LeHavre to Paris was raw sugar, much of which had been formerly carried by road. Over 20,000 tons of sugar were transported each year from LeHavre to Paris during the late 1830s. Coffee was another commodity to use direct transport, though much of it seems still to have been carried by road. Much of the iron imported to LeHavre was also shipped direct to Paris.

The increasing use of steamers in the domestic and European coasting trades undoubtedly also acted as a stimulus to the development of faster direct transport from LeHavre to Paris. Faster and more costly sea transport would be wasted if inland transport were to remain almost as costly but much slower. In 1839 a total of 880 steamers of almost 145,000 net registered tons entered the port of LeHavre, sixty per cent of this tonnage coming from foreign ports. In both coasting and foreign trades about one-fifth of the ships coming to LeHavre

by this time were steamers. Very few steamers were yet venturing up the Seine to Rouen, except those coming only from LeHavre, and only about three per cent of the coastal shipping tonnage entering Rouen in 1839 was steam-powered. LeHavre therefore was the terminus for ocean-borne steamshipping, and onward connections to Paris had to begin there. Looking through the pages of the Journal du Havre and its daily lists of chargements de navires, one sees that these ocean-going steamers carried a wide variety of high-value and perishable cargoes; three examples are given in Table 6. Many of those calling at LeHavre were of foreign registry — increasingly so during the 1840s — but from early in the 1830s several French companies engaged in this trade. Of particular interest were several companies formed in LeHavre after 1834 to serve Hamburg, Amsterdam, Antwerp, Copenhagen, St. Petersburg, London and Lisbon.³²

Table 6

Examples of Steamer Cargoes Arriving in LeHavre in 1839

(1) The AMSTERDAM of Albrecht et Cie arriving from Rotterdam on the 26th of February 1839, with a cargo of:

5 caisses de manufactures	5 caisses de plantes
3 caisses de drogues	4 baïes de tilleuls
1 boîte de semences	1 caisse de tableaux
359 paquets de peaux	4 caisses de liqueurs
1 caisse de challes	6 caisses de céruse
2 caisses de vin	3 caisses de ciseaux
300 lingots d'étain	4 caisses de porcelaine
2 caisses de manufactures	1 boîte de plumes
1 caisse de porcelaine	31 caisses de cachou
9 balles de tabac	1 balle de cannes
1 fût de rubans	1 caisse dents d'éléphants
8 caisses de manufactures	1 partie de bois
2 caisses de bois	8 barils de safranum
2 caisses de livres	2 caisses de gomme
1 caisse de laine	1 sac de pommes de terre
612 lingots d'étain	16 caisses d'indigo
262 paquets de peaux	2,186 bois de Brésil
1,900 fromages	52 paquets de feulliards
304 lingots d'étain	5 caisses de manufactures
1 caisse d'instruments	106 balles de tabac
5 caisses de liqueurs	1 caisse de livres
14 fûts d'huiles	1 panier de saumons
50 paniers de terra Japonica	

(2) The OCEAN of the Cie Neustrienne pour les Bateaux à vapeur entre LeHavre et Honfleur, arriving the 26th of February 1839 from Cherbourg with a cargo of:

128 fûts de salaisons	18 stères de bois à bruler
6 porcs vivants	12 colis de marchandises
2 barils de lard	12 caisses d'eau-de-vie
163 pots de lard	1 fût d'eau-de-vie

(3) The PHENIX of the Cie des Paquebots à vapeur entre LeHavre et Londres (Cie Guillon), arriving the 2nd of March 1839 from London with a cargo of:

1 caisse d'oranges	1 caisse d'histoire naturelle
3 ancres	7 sacs de laine
15 morceaux d'appareils	2 rouleaux de fer
2 fûts de vin	1 caisse de bois de lit
1 balle de tissus	2 caisses de machines
1 caisse de calicots	2 roues de machines

Others were formed in 1837 to serve a number of French ports, in particular Bordeaux, Morlaix, Cherbourg and Caen, and by 1840 there were steamer services operating out of LeHavre spanning the whole distance from St. Petersburg to Marseille.

There had been concern in Rouen for a number of years that the growth of direct transport from LeHavre to Paris was doing permanent damage to the city's commerce. This fear was also reflected in the city's opposition to a railway by the plateau, indeed to any railway all the way to LeHavre. A committee of the city council delegated to study the matter in 1833 had stated that "depuis que les chalans remorqués et les bateaux à vapeur se sont emparrés de la Basse-Seine, la navigation des navires à voiles, la seule qui puisse faire prosperer le beau port de Rouen, a toujours été en décroissant."³³ It was imperative that this state of affairs should cease, it continued, or the 150 or so allèges would be eliminated from the trade and the bateaux normands seriously threatened. The best way to prevent its growth was to make it easier for allèges to reach Rouen. A protest was made to the Minister of Commerce against a rise in rates for tugging allèges by Bertin, which "par son exhorbitance, interdit complètement le remorquage de ces batiments."³⁴ Suggestions were made by an assemblée commerciale in March 1832,³⁵ but against the advice of the Chambre of Commerce in Rouen, that tugging of all allèges of over fifty tons be made compulsory, in the hope that this would help to convince captains that coming up to Rouen could be economic if it were done safely. This suggestion drew

protests from LeHavre,³⁶ and it was rejected by the Conseil supérieur de commerce.³⁷ At the same time, in a more positive vein, efforts were revived to organize a tugging company based in Rouen and devoted exclusively to serving its interests. The commission of the city council delegated to study the problem reported its findings in August 1833.³⁸ It was certain that traffic in the port of Rouen could be increased by "un remorquage bien organisé", and it recommended that the city give a subsidy of up to 30,000 F per year for three years to any company which would undertake to operate two tugboats exclusively for towing sailing vessels between LeHavre and Villequier. Although the offer of a subsidy remained for two years, and was then raised to 20,000 F per year for six years, no suitable offers were received.

Success was achieved in 1836, and without the aid of a subsidy. In the last months of 1835 a group led by Casimir Caumont, president of the Chambre of Commerce in Rouen, began forming a company to operate some tugboats, and since they did not wish to use the subsidy offered by the city, they asked that it be withdrawn.³⁹ By September 1836 the company's 300 shares had been subscribed, and by January 1837 operations were being organized.⁴⁰ An old tugboat which had been built in Liverpool in 1819 the fifty-horsepower PILOTIN, was acquired for 95,000 F,⁴¹ and the hull and engines for a second to cost 230,000 F were ordered. On the last day of 1837 the PILOTIN began operations, and by early in 1838 the second tugboat, the ROUENNAIS, was also in service. Though the company had been formed exclusively to serve the interests of Rouen by towing sailing vessels, it was not long before it was forced also to begin towing chalands. Chalands and sea-going vessels seem to have been necessary complementary sources of revenue; chalands could be towed when low water or the off season made towing of sea-going ships less remunerative. The revenue from towing sea-going ships was on the other hand necessary because of the very narrow margin of profit earned in towing chalands. The company therefore set about to provide a regular once weekly chaland of 300 to 400 tons from LeHavre to Rouen. For this purpose its capital was more than doubled from 325,000 F to 725,000 F and another tugboat, the ROUEN of 160 horsepower (the most powerful yet to appear on the Seine), and four large chalands were purchased.⁴²

Road Transport Resumes its Growth.

Despite the progress made by steam and by chalandage, a very large proportion of the total water-borne transport from Rouen to Paris was still being carried in large bateaux normands. Most operated accéléré, but they were still hauled by horses and took seven to ten days to reach Paris. In 1845, according to Henry Maillet-Duboullay,⁴³ there were about 240 of these boats in operation owned by about 160 bateliers; halage also occupied seven to eight hundred men and fifteen to eighteen hundred horses. As goods traffic increased during the late 1830s, the price of water-borne transport also increased, by agreement among the bateliers according to one author.⁴⁴ The rate per ton from Rouen to Paris rose to a maximum of over 24 F in 1842 and 1843, double what it had been a decade earlier.

The apparent failure during the later 1830s of water-borne transport to provide sufficient capacity with adequate speed and at low cost created a rapid increase in the use of road transport. This was remarked upon by members of the extra-parliamentary commission on railways late in 1837.⁴⁵ The initial effect of the innovations in water-borne transport made during the 1820s had been to reduce greatly goods transport by road. After 1837 and 1838 however, traffic on Route Royale N0. 14 seems to have risen to a very high level. An ingénieur des routes charged with a project to improve a short section of the road between LeHavre and Harfleur remarked in 1843 that⁴⁶

nous n'avons cessé de dire que le roulage partant du Havre ou y arrivant est énorme, que la masse des transports et des voyageurs a cru dans une proportion peu commune, que les voitures non soumises au pèsage, allant au pas pour le roulage, ou au trot pour les voyageurs, au galop pour les dépêches se multiplient visiblement.

During planning for the Paris-to-Rouen Railway in 1839 and 1840, estimates were made from observation and from inspection of road haulage company records of the amount of road traffic between Rouen and Paris. It was estimated, perhaps somewhat over generously, that in 1839 188,500 tons of travelled between Rouen and Paris by road.⁴⁷ This was more than two and a half times the amount carried by road in 1824. Over the same period water-borne traffic had increased by only about two-thirds. The only reasonable explanation for this enormous growth of

road transport, and the commission des chemins de fer were agreed upon this, was that shippers were demanding greater speed, and water-borne transport could not provide it.

Road transport was considerably improved during the 1830s, as a result of improvements both to the roadway and to the vehicles which used it, and there is no doubt that this encouraged the growth of goods traffic by road. By the early 1840s, there were more than a dozen commissaires de roulage at Rouen and seven at LeHavre. Varnier frères, entrepreneurs des transports by water and by road, advertised departure of six daily services, and transport from LeHavre to Paris in the remarkably short time of only 36 hours.⁴⁸ This company is reported to have adopted four-wheeled wagons late in 1838, which were easier to unload, and so helped to reduce much complained of damage to goods, which seem often simply to have been flung out onto the muddy ground. The use of steam for road transport also had its advocates, but nothing came of this in France until much later in the century.⁴⁹

The condition of France's roads improved dramatically in the first half of this decade. The length of routes royales in good repair increased by half over a period of nine years, from about 17,000 kilometres in 1827 to about 25,000 kilometres in 1836. This is shown in greater detail in Table 7.⁵⁰ The condition of Route Royale NO. 14 between LeHavre and Paris followed this national pattern, the improvement being especially great between Rouen and LeHavre. The number of kilometres in good repair rose from only 68 in 1822 (out of a total distance of 210 kilometres), to 117 in 1836.⁵¹ As Table 8 shows, there was some deterioration of the stone-paved road closer to Paris.

Table 7

The State of Repair of Routes Royales in France

approximate years:	<u>1822</u>	<u>1827</u>	<u>1836</u>
<u>the state of repair</u>		(kilometres)	
en état d'entretien	14,288	16,820	24,717
à réparer	14,348	12,664	5,852
à terminer	3,440	3,256	3,942
TOTALS	32,076	32,740	34,511

Much attention had been devoted during the decade before 1836 to developing improved methods of road construction and maintenance. The first Statistique des Routes Royales prepared under Becquey and published in 1824 had stimulated great interest in improving the country's roads, and led to many years of discussion and experimentation on the methods used in their construction and maintenance. As had occurred in other areas of transport, Ponts et Chaussées engineers were sent abroad to other countries, especially to Great Britain, to study foreign methods.

Table 8

The State of Repair of Route Royale N0. 14, 1822 and 1836

(kilometres)				
<u>département</u>		<u>état d'entretien</u>	<u>à réparer</u>	<u>à terminer</u>
Seine	1822	3.572	1.800	-
	1836	2.991	2.381	-
Seine-et-Oise	1822	52.566	3.177	-
	1836	38.950	15.800	2.000
Eure	1822	9.851	26.500	-
	1836	17.746	18.604	-
Seine-Inf.	1822	2.005	102.536	0.930
	1836	67.136	47.001	-
<u>Totals</u>	1822	67.994	134.013	0.930
	1836	116.823	83.786	2.000

Although some progress seems to have been made during the Restoration on the initiative of individual engineers — there were many enthusiasts of British methods — real progress was not made until after 1832, when Legrand became Directeur-général des Ponts et Chaussées. He took Ponts et Chaussées activity beyond the stage of discussion to that of widespread experimentation and implementation. Not only did he issue circulars like the one sent to all prefects in December 1833⁵² pointing out the need for extra care in maintaining the roads in winter, but also, with the aid of stability in the State's finances, began large

expenditures on road repair and construction. Annual ordinary expenditure on roads rose from about 20 MF during the Restoration⁵³ to over 30 MF by the mid-1830s, and to over 40 MF in 1847.⁵⁴ A law of May 1837 gave almost 115 MF for extraordinary works on roads, most of it for already existing roadway.

There were changes during this decade in road-building technique. In 1833, on the suggestion of Berthault-Ducieux, one of the country's leading road engineers and a very prolific writer on the subject, the Ponts et Chaussées established a special service d'expériences to investigate new methods of construction and maintenance.⁵⁵ Some experiments on a small scale had been carried out during the Restoration on the viability of using MacAdam's techniques in France.⁵⁶ After a visit to Great Britain in about 1822 Navier had recommended⁵⁷ that the Administration adopt some of the ideas of MacAdam, and build roads with greater attention to sub-soil and proper drainage, giving closer attention to daily maintenance; these things he believed, would make for better road surfaces than the heavy foundations and great thicknesses of surface material then thought necessary in France. During the thirties research was carried on by engineers of the Ponts et Chaussées, notably Navier, Emmery, Dupuit and Morin, with much of the results published in the Journal du Génie Civil and the Annales des Ponts et Chaussées. The culmination of all these activities was a circular to Prefects on the 25th of April 1839 entitled "Instructions sur les méthodes à suivre pour l'entretien des routes",⁵⁸ which was repeated annually for a number of years. Roads in good repair, it stated, must at all times be kept clear of dust, which contributed to the formation of mud, and all materials removed from the road's surface must immediately be replaced. Expensive traditional methods of road construction, it continued, could in this way be avoided; "puisque'avec des soins continus, on est maître d'empêcher que les dégradations ne descendent jamais au delà de quelques centimentres, il s'ensuit que ces grandes épaisseurs de chaussées qu'on construisait autrefois sont complètement inutiles...." The average couche d'empierrement, according to Michel Chevalier,⁵⁹ was reduced from forty or fifty centimetres at the beginning of the century to only fifteen or twenty by about 1840. One of the most important conditions of effective maintenance, said the circular, "c'est d'avoir toujours

sur la route une grande quantité de main d'oeuvre à sa disposition." Four years earlier, in 1835, the cantonniers had been reorganized to permit more labour-intensive maintenance,⁶⁰ and according to a Ponts et Chaussées engineer writing in 1845,⁶¹ the proportion of labour to materials (by value) had increased by then to almost seven times what it had been before 1835. By 1856 the Minister of Public Works was complaining that the principles outlined in the circular of 1839 were being applied to excess.⁶² In the meantime however, including the few years before the railway was opened to Rouen and LeHavre, the evidence shows that progress was made in improving the condition of many roads. Attempts at the same time to reduce the maximum permitted vehicle weights however, were unsuccessful. An ordinance of 1837 reduced the permitted maximum weight of the largest type of two-wheeled vehicle from 5,800 kilogrammes to 4,900 kilogrammes,⁶³ but owing to pressure from the road transport operators, this measure was never put into effect.

First Steps in Canalization of the Seine.

One large obstacle preventing any further improvement in speed by river transport was the shallow and variable condition of the river; nothing could be done about this by the operators of river transport. There had been some improvement in speed during the thirties over performance in the previous decade, but there was probably little potential for more as long as the vessels then in use remained. The average total round-trip voyage time for Bertin's chalands had been reduced from forty days in 1827 to about 25 days in 1835,⁶⁴ and by the mid-thirties some trips were being made all the way to Paris with the aid of tugboats. Charles Bérigny had pointed out in 1834⁶⁵ that to a great extent "les améliorations obtenues...sont dues à l'activité, au zèle, et aux efforts des mariniers." But, he said, little further improvement could be expected from the mariniers while the river remained in its existing condition, for "tout ce qu'ils pouvaient faire, ils l'ont fait...." Tow-paths for bateaux halés remained in very poor condition, and all types of boats still encountered stretches of shallow water, pertuis and narrow bridge arches. Most steamers still had for example to be pulled by hand through the narrow arches of the Pont de Vernon, until improvements were made to it in 1844.⁶⁶ Steamers operating only

on the Basse Seine, like the DORADES, the INDUSTRIE and the PILOTE had very shallow draughts, from Om.80 to lm.20 fully loaded, but consequently had very small engines, only forty horsepower for all these three boats, and small capacity.⁶⁷ Bertin's three REMORQUEURS however, had engines of 80 to 100 horsepower and drew over lm.80. With the depth of water falling to less than a metre in some places for up to six months of the year, operation of tugs was made rather difficult.

Natural waterways like the Seine had for many years been neglected while resources were directed toward building canals. In the early 1830s however, there was an important change in policy by the Ponts et Chaussées. First, the State became much more directly involved in improvement of waterways. For some time it had been evident that the cost of building the canals begun in 1821 and 1822 would be much greater than estimated, and by the end of 1832 the State had spent 27 MF to cover the excess. At the same time it had also become evident that the new waterways provided by this programme, of which about half were by then in operation, were far from being a complete transport system. This could be obtained only by improving the many equally important connecting natural waterways. In 1833 therefore, while the government of Marshall Soult asked the Chambres for another 62 MF to wind up the still uncompleted canals, it also began to study ways to improve navigation on a number of rivers. It was at this time also, it will be recalled, that a fund of 500,000 F was obtained for the first systematic study of railways.

This was the beginning of an immense programme of transport development during the July Monarchy, with total public expenditure reaching almost 1,300 MF by the end of 1847.⁶⁸ The first concrete manifestation of the new policy was a group of bills presented to parliament in 1835 proposing concession of one major railway, the Paris-to-LeHavre, and improvements to several natural waterways. Subsequent legislation approved six million francs to be applied to five important rivers. Further proposals for railway development, it will be recalled, came in 1837, and in the same year the government obtained an additional 71 MF for several rivers.⁶⁹ Further legislation in almost every year up to 1848 brought the total for improvement of waterways (both canals and rivers) to over 375 MF. Though more than half

of this was spent on artificial waterways, the imbalance in their favour was largely corrected. Whether for fear of competition between them development of both waterways and railways should continue together hardly became a live issue during the 1830s. Thiers was quite accurately expressing the prevailing belief when he stated in 1835 that⁷⁰

La création des chemins de fer est loin...d'être exclusive du perfectionnement des voies navigables. Les chemins de fer sont destinés surtout au transport des personnes et à celui des marchandises d'un prix élevé; mais la voie des canaux et des rivières sera généralement préférée pour les matières encombrantes.... Nous devons donc...poursuivre avec ardeur l'établissement de ces deux modes de communication qui sont appelés à rendre des services distincts....

Even in 1838, when the railway boom was at its height, Michel Chevalier warned that⁷¹

il faut que nous gardions de procéder avec précipitation et de toutes parts à l'exécution des chemins de fer, et que nous devons réserver à la navigation la majeure partie des fonds que nous pouvons actuellement consacrer aux travaux publics.

In September 1833 the Directeur-général des Ponts et Chaussées once more asked Charles Bérigny to draft a proposal for canalization of the Basse Seine. It was just ten years since Becquey had given him the same assignment. The technology of canalization had advanced very little however, in the meantime, and although since 1829 several schemes had been proposed, no plan had been devised which was clearly acceptable both to the engineers and to the existing users of the river. Therefore, if any progress was to be made toward improvement by canalization, some new idea or invention was required. Though the plan proposed by Bérigny was not a satisfactory one, his report, which he submitted to the Conseil-général des Ponts et Chaussées in January 1834,⁷² provided an admirably thorough examination of the technical problems needing solution. The essence of the problem of course was to raise seasonally low water levels at certain places on the river to a depth sufficient for the largest boats in common use to navigate easily with full loads at all times. Bérigny suggested that the objective should be to obtain a minimum depth of two metres at lowest water, called étiage. In order however, to protect existing water-borne transport, the system devised to raise water levels had to meet a number of conflicting requirements. First, while controlling the flow of water to increase available depth at étiage, it must

also permit unobstructed passage in the main river channel at times when adequate water levels existed naturally. It must not increase the speed of the current or otherwise adversely affect the river's flow, either upstream or downstream from any fixtures which might be built. It must be simple to operate and to maintain. It must be strong enough to resist damage from heavy peak water flows and from ice. And lastly, it must also be reasonably economical to build.

The techniques for meeting all of these requirements did not yet exist. Indeed, there had been no really important advances in the techniques for canalization of rivers since the sixteenth century. The first canalization of any river in France had taken place on the river Lot in the thirteenth century. The method used was the construction of a partially moveable dam, a structure of masonry with openings in which were inserted a varying number of horizontal or vertical slats, or gates, later known as 'portes marinières'; these were designed to allow passage both of a small amount of water and of boats, and to maintain an artificially deep channel upstream from the dam. However, this system had a number of faults. The narrow openings of the portes marinières increased the speed of the current as it flowed through and made upstream passage of boats very difficult. The narrow outflow through the portes marinières increased the danger of damage to them from seasonal crues and from ice, of which there was a considerable amount in the Seine during most of the nineteenth century. Finally, the accelerated flow of the current caused deposits of sand and gravel, which eventually blocked the channel. Several of these problems were eventually solved, at least in part, by the introduction of simple locks. This had occurred during the reign of François 1^{er}, and was the last important advance in the technology of canalization before the mid-nineteenth century.⁷³ The first lock in France was built on the Ourcq in 1528, and the first river to be canalized with a combination of locks and dams was the Vilaine, where work was begun in 1539 and completed in 1585.⁷⁴ Attempts had been made at canalization by other means, for example, by restricting and directing a river's channel with fixed jetties perpendicular to the shore, but this had produced discouraging results.⁷⁵

The system of canalization proposed by Bérigny for the Basse Seine was a well-known one, using locks and dams combined

in much the same way as they had been on the Vilaine. He proposed a series of twelve dams and locks, one just downstream from each of the haut-fonds or pertuis between Rouen and Paris. Each dam would consist of masonry pillars spaced across the river, forming flues or pertuis⁷⁶ about ten metres in width; each pertuis would be equipped with a sort of gate or poutrelle built in sections so as to be variable in height or width. At one end of each dam would be a lock. The dam would raise the water level upstream, and could be gradually opened as the natural water level rose, thus allowing a greater free flow and maintaining a fairly constant water level. Bérigny estimated that the cost of such a system for the whole Basse Seine would be about 17.5 MF.

The Conseil-général des Ponts et Chaussées was undecided about Bérigny's proposal. It was sent first to a committee of the Conseil, which eventually reported its recommendations in March 1835.⁷⁷ The committee examined not only Bérigny's proposal, but also several others. Among these were two by Coic and Duleau⁷⁸ and by Charles Monier;⁷⁹ both however, were rejected as too costly and unlikely to be successful. Though they recommended some changes, the committee agreed in principle with the system proposed by Bérigny. At two places where canalization was likely to be especially difficult, Chatou and Maisons-Laffitte, they suggested that short sections of lateral canal be built; they also recommended that the tow-paths along the whole of the Basse Seine be improved or rebuilt, at an estimated cost of one million francs. The committee's recommendations were not however, accepted by the full Conseil, and discussion there went on inconclusively through ten meetings from April to July. Five members of the Conseil were willing to accept some type of damming, but four were quite opposed to any.⁸⁰ Some of those opposed would have preferred a system using short sections of lateral canal to by-pass every shallow section of river, or simply a single lateral canal all the way from Rouen to Paris. On the other hand, one member, Mallet, who had worked with Defontaine on the railway and was also a deputy for the Seine-Inférieure, was opposed to any kind of canal or canalization which would involve locks. This was known to be the attitude of the river's users. Even among those who were in

favour of Bérigny's system, there was disagreement as to the type of dams to be used. Some favoured dams like those recently built on the Oise, which would be more fixed, solid and less susceptible to damage. It was objected however, that these would restrict the flow of water into fewer and narrower pertuis, speeding up the rate of flow, causing silting and altering the water's flow upstream. The Conseil was agreed only that a minimum seasonal depth of only 1m.60 rather than two metres as suggested by Bérigny would be sufficient between Paris and Rouen, but that any locks constructed should be capable of deepening to two metres. By mid-July it was evident that the Conseil-général had reached an impasse, and that some kind of compromise or 'second best' solution would eventually have to be worked out.

In the event a way was found out of this impasse almost within weeks. The way out was a new type of moveable dam, seen later to have been a very important technical advance. Some credit for this rapid solution to a difficult problem must go to Legrand, Directeur-général and ex officio chairman of the Conseil-général. He had very ably provoked and guided the discussions of the Conseil, and had remained sceptical of any system of canalization which would inhibit passage of boats during the high-water season when dams and locks were unnecessary. While ensuring therefore that such an unsatisfactory system was not imposed upon the unwilling users of the river, he also encouraged the development of innovations which might lead to a solution being found. Late in August 1835 Legrand brought to a meeting of the Conseil-général two Ponts et Chaussées engineers, one a very well-known authority on hydraulics, the baron Riche de Prony, the other an unknown ingénieur de service, Charles Poirée; each had a new system of dams to offer. Prony's proposal was rather sketchy, and does not seem to have aroused much interest. Much more interest was shown in the proposal by Poirée. Charles Poirée had been chief engineer on the Canal du Nivernais since 1826, where he had been working since late in 1823.⁸¹ During 1834 he and a colleague, Chanoine, had built a dam of entirely new conception on the Canal du Nivernais near Basseville, where it crosses the Yonne.⁸² In essence Poirée's invention, which came to be called the 'barrage à fermettes mobiles', was very simple. It made ingenious use of iron in the form of fermettes

or light rectangular frames which could stand upright in the river stream, parallel to the direction of flow. The base of each fermette was attached to the river bed so that it could turn freely on this axis. During low water, the fermettes would be kept upright, a wooden walkway laid across the top and the water held back by vertically positioned wooden planks or aiguilles. As high water season approached the aiguilles could be removed one at a time, and finally the walkway removed and the fermettes rotated on their axes to lie flat on the river bottom. The system had been very simple to operate and very rigid against quite heavy flows of water. Furthermore, it had been quite inexpensive to build. The simplicity and great success of the invention had aroused the interest of other engineers, and late in July 1835 a committee of them had visited the dam site to observe its operation. It seems then to have come to the attention of Legrand, who was particularly attracted to it. Legrand recommended it enthusiastically to the Conseil-général for application on the Seine, where it would allow completely free passage of vessels during high water. During two meetings over the following week Poirée further elaborated upon his system; there was some disagreement however, as to whether such a system would be as efficient in raising water levels as would that of Bérigny. Finally it was agreed that both systems should be tested on the Seine. Public inquiries would be held to determine the details of construction for Bérigny's dams at Poissy and Andrésey, and Poirée was asked to prepare a draft project for the whole Basse Seine from Rouen to Paris.⁸³ With these and other steps taken, the Conseil-général prepared the way for a final decision, perhaps during the following year.

Public inquiries on proposals for the Seine opened in December 1835 and fully confirmed expectations. As Legrand had reminded the Conseil-général on several occasions, the river's users were unanimously opposed to any dams or locks which would give anything less than completely unhindered navigation during the high water season. Many of the public bodies consulted during the inquiries also remarked that construction of locks of almost any dimensions would restrict future development of river boats. "Il vaudrait mieux cent fois," stated the Chambre of Commerce in Rouen,⁸⁴ "conserver au fleuve sa liberté native avec ses inconvénients actuels et momentanés, que de le captiver

dans des liens dont l'avenir ferait à coup sûr déplorer l'idée." The Chambre of Commerce in Elbeuf described Bérigny's proposal as an "escalier nautique", an absurdity to which it was opposed. Commissions of inquiry in Rouen and in Versailles both rejected Bérigny's proposal, and only under protest did they answer questions put to them by their respective prefects about lock dimensions and other technical details. What the chambres of commerce and commissions of inquiry wanted were dredging of dangerous haut-fonds, improvements to tow-paths, construction of dykes, jetties and dams to close off secondary arms of the river, enlargement of some bridge arches, and canaux de dérivation at a few places. The Chambre of Commerce in LeHavre was concerned also that any improvements should accommodate steam tugs, and it asked that the depth at low water be increased to 2.m50; it did not mention the tow-paths.⁸⁵ On the other hand, the Chambre of Commerce in Rouen began its reply by stating that any improvements to the Seine should begin with the Seine-Maritime, essential to retention of ocean-going shipping at Rouen.⁸⁶ Any improvement of the Seine from Rouen to Paris while it remained unimproved from Rouen to LeHavre, it said, would threaten to by-pass the port of Rouen almost as much as would a railway by the plateau.

With this response from the public inquiries, the decision to adopt Poirée's invention was almost inevitable. His completed avant-projet was submitted to Legrand in February 1836,⁸⁷ and the entire dossier was sent to Cavenne, rapporteur on the project to the Conseil-général, nine months later. Cavenne submitted his report⁸⁸ at the beginning of December 1836, and after four more sessions of the Conseil a final decision was reached. The Conseil recommended to the Minister that Poirée's system be given a trial between Bezons and Marly, where it would provide a way around the old pertuis de la Morue, probably the most dangerous and difficult passage on the river. For this purpose, and to continue the project, an annual amount of 600,000 F should be requested from parliament.⁸⁹ This recommendation was accepted by the government, and the project for the Seine included in the large programme of transport improvement presented to parliament in the spring of 1837.

Four bills were presented for improvements to waterways, and the programme also included several other bills on railways and harbour improvements. While those for railways met with

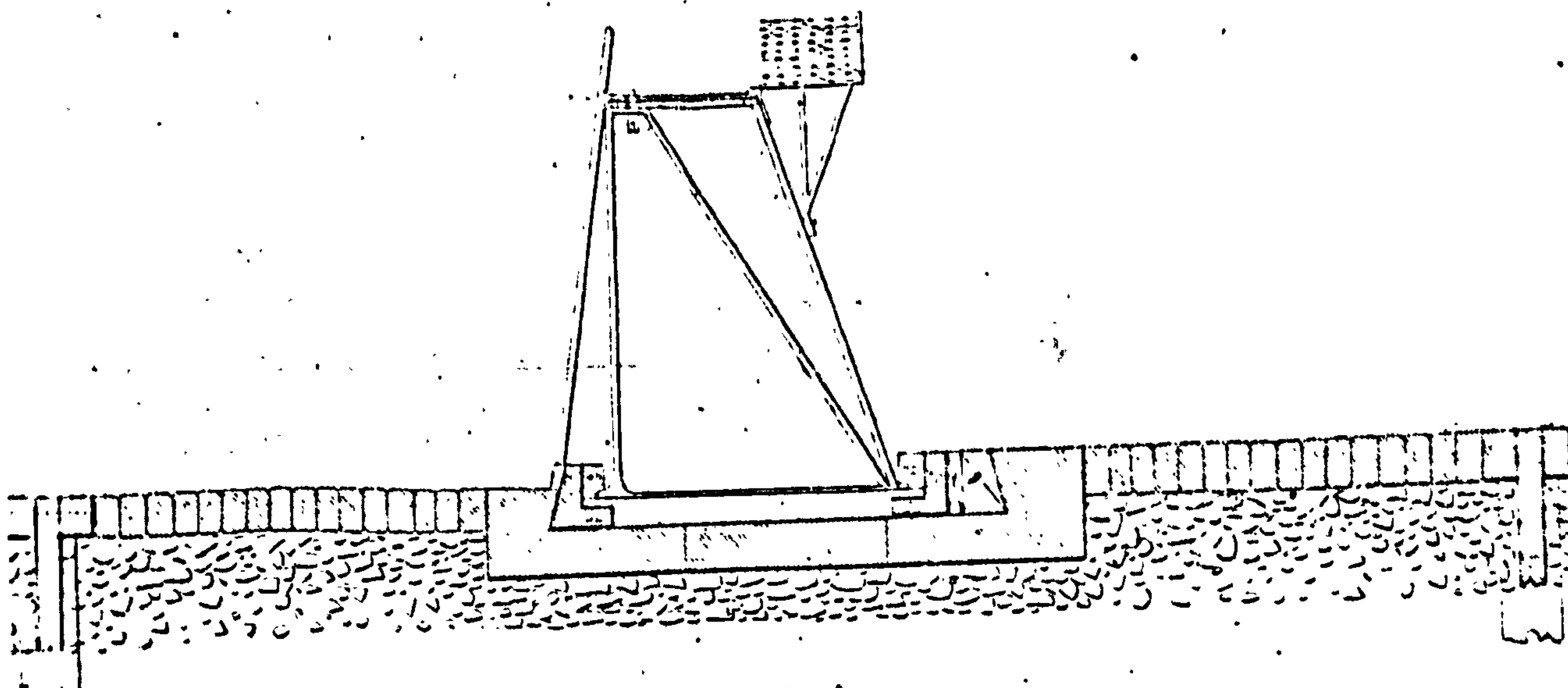


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Figure 12. The 'Barrage à Fermettes Mobiles'.
(From Le Journal de l'industriel et du capitaliste, 1837, plate 10.)

great opposition and were eventually abandoned at the end of the session, the river improvement bills were quickly and easily passed with very little discussion and very little opposition.⁹⁰ The total amount voted for waterways in 1837 was over 71 MF, of which four million were for the test of Poirée's scheme on the Basse Seine. As well as the project at the pertuis de la Morue, this credit had also to cover enlargement of bridge arches at Meulan, Vernon and Pont de l'Arche, dredging at several points, and construction of filled-in crossings from islands to shore to reduce the number of ferry crossings by tow horses. Tow-paths were also to be improved. There was a further 2,170,000 F granted for the upper Seine and the Yonne, and of these amounts, totalling over 6 MF, 200,000 F were to be spent in 1837 and 1,680,000 F in 1838.⁹¹

With his project now embodied in legislation, Poirée was given every facility to carry it quickly through into effect. The deadline for completion was the 1st of January 1840. Already in September 1835, only a fortnight after being asked to submit a plan for the Seine, he had been raised to the grade of ingénieur-en-chef de la première classe, and a month later on the 10th of October 1835 had been given indefinite leave from his post in the Nièvre to make a detailed on-site examination of the lower Seine and to prepare his draft project. In July 1837, as the legislation was being passed, the Ponts et Chaussées set up a new organization to conduct its various projects on all parts of the Seine, dividing it into four sections from the Aube to LeHavre; from Paris to Rouen was the 3e Section, from Rouen to LeHavre the 4e Section. In October 1837 Poirée was put in overall charge of the Service de la navigation de la Seine, and in the following July raised to the grade of ingénieur-en-chef directeur.⁹² Construction was completed almost on schedule. A contract for construction of the épi mobile at the Morue seems to have been let as early as March 1837⁹³ before the legislation had even been passed. The épi at the Morue was completed during 1838, and with obstructions caused by the old pertuis removed, it was opened for use in November 1839. It worked very well, and the most dangerous place on the old Seine eliminated. The derivation at Marly was completed and given over to use in July 1840. With the numerous other works done nearby, the total expenditure up to the end of 1840 was 2,059,823 F.⁹⁴

There is no doubt that Poirée's invention of the barrage à fermettes mobiles was of major importance,⁹⁵ for without it satisfactory canalization of the Seine would have been long delayed. Before the invention could be used on the lower Seine however, a considerable work of adaptation was necessary. In essence though, the system remained very simple. It had two elements. In order to avoid difficult passages of haut-fonds and rapids, Poirée proposed to divert the navigable channel through secondary arms of the river; in the few places where this was not possible there were easily accessible flat banks, and sections of lateral canal could be built. In his report of the 18th of February 1836,⁹⁶ Poirée gave credit for this idea to the engineers Coic and Duleau who had originally suggested this in 1830, and also to inspecteur de la navigation Charles Monier, who had raised the idea in a slightly different form in 1832. In each of these derivations would be placed submersible locks, built so that at periods when the natural water level exceeded lm.60, the river would simply flow over their gates; at these times of course boats would be using the main channel. There remained the problem of maintaining sufficient depth in the channel and through the locks at low-water times; it was this which had prevented implementation of the proposals of Coic, Duleau and Monier, and it was here that Poirée's invention came in. However, whereas in its previous application on the Yonne it had taken the form of a complete dam, the volume of flow in the Seine was much larger at étiage and only an épi or jetty was required. This épi would project into the main channel from the shore on which was located the derivation; as the water level fell, more of the fermettes would be raised. Maintenance of the proper minimum depth of lm.60 would require simply a daily check and adjustment of fermettes and aiguilles by the garde-épi. During low water, boats going upstream would use the locks, those going downstream would pass by the far end of the épi. An opening of at least 20 to 30 metres would be left at all times on the opposite shore, and steamers could use this for passage in both directions. At high water seasons, the épi would be entirely lowered, and the river would return to its native state. It was an ideal solution, meeting all requirements.

CHAPTER SIX

Building the Railway to the Sea, 1840 to 1850

During the 1840s railways were built throughout the length of the lower Seine valley. An attempt to build the whole system at once had failed, so the task was now undertaken in three overlapping stages by three closely related companies, with the rails reaching Rouen in 1843, LeHavre in 1847 and Dieppe in 1850. The role of foreign capital, technique and even labour was considerable at all three stages, and though small but comparison, the role of local initiative and local capital was not insignificant. The corner stone in the edifice was the line from Paris to Rouen, where the largest potential volume of passengers and freight, and the best prospect of solid financial success were to be found. Creation of these and other railways may be decomposed into three separate processes. The first was organizing a company grouping together sufficient capital to build the railway, and concurrently obtaining parliamentary sanction for a concession and for any required assistance from the State. The second was constructing the railway and equipping it with rolling stock. The third, overlapping with the second, was realizing the capital funds subscribed by participants in the company and providing for extra funds should they be needed.

Organizing Three Railway Companies.

Within weeks of rejection by the Chambres of the proposed changes to the cahier des charges of Chouquet, Lebobe et Cie, and some time before it was formally dissolved, a new company was being organized to take its place. The initiative came from a hitherto unimportant firm of Paris bankers, Charles Laffitte, Blount et Cie, the first partner in which was a nephew of Jacques Laffitte. The elder Laffitte had been a supporter of the Riant Cie since its beginnings in 1834, and like Riant's, this company proposed following the valley route. It also proposed to built its line only as far as Rouen. Unlike

Riant, Laffitte and Blount did not refuse assistance from the State, and late in 1839 they were given a tentative offer by Dufaure, Minister of Public Works,¹ of 6 MF toward the company's capital; a short time later this was raised to 16 MF, or about one-third of the total required capital.

For several months the activities of Laffitte and Blount seem to have attracted little attention in France. Their main area of activity during the rest of 1839 was Great Britain. Determined to fortify themselves against the weaknesses of the capital market in France, they decided to search for stronger foundations abroad; the Morning Post of London, it will be recalled, had commented the year before that foreign capital would be needed. These two men were ideally suited to pursuing such a 'foreign strategy', and they were to play a considerable role during the next decade in obtaining British capital for French railways. Blount was a native of Staffordshire and the firm were bankers for the British Embassy and one of the principal agents in Great Britain for the sale of French rentes.² Great Britain moreover was very open to such a strategy. As Britain had become absorbed in her own 'railway mania' of the 1830s, the sale of rentes had declined, but British investors showed considerable interest in early French railways like the Paris-to-St.-Germain.³ By 1839 the rate of railway company formation in Britain had fallen very low,⁴ and British investors seem to have been looking abroad for new investment opportunities. British investment in continental industry was certainly not new, but this initiative by Laffitte and Blount was the first direct appeal by a railway for British funds on such a large scale, and it resulted in the first large British investment in French railways.

Early in August 1839 Edward Blount travelled to England, visiting a number of people interested in railways in London, Manchester and in Liverpool, which at that time was the centre of the railway capital market in Great Britain.⁵ In Liverpool he saw Charles Laurence, chairman of the Liverpool and Manchester Railway, and John Moss, a banker and one of the founders of the Grand Junction Railway. At the same time efforts were directed toward those with the greatest interest in the success of a railway to LeHavre, the owners of the London and South-western Railway whose terminus was at Southampton. In the first

days of August Charles Laffitte went to London and appeared at a Board of Directors meeting of the L.S.W.R.⁶ and persuaded them to support his enterprise. A few days later on the 7th of August Laffitte spoke to the shareholders of the L.S.W.R. during their general meeting.⁷ He made no direct appeal to them at this stage for funds, but only for the services of an engineer. The influential Board of the L.S.W.R., including its chairman Sir John Easthope, M.P. and publisher of the Morning Post, decided to back Laffitte, and within weeks two of its members, William Chaplin and William Reed, accompanied the company's engineer Joseph Locke to France to look over the proposed route and estimate the line's potential traffic. The results of their investigations were very encouraging; Chaplin said "the traffic between Paris and Rouen surprised him, that it far exceeded the traffic upon any route in this kingdom."⁸ At their next general meeting on the 29th of February 1840 the directors recommended Laffitte's company as a worthwhile investment, and furthermore, "highly advantageous as (a feeder) to the traffic" of the L.S.W.R.⁹

The growing impetus behind this attempt to organize a new company to build a railway by the valley, and only to Rouen, could not fail to excite opposition from LeHavre and from Dieppe. Indeed, the battle of valley versus plateau had been rejoined with letters and petitions even before dissolution of Chouquet, Leboe et Cie.¹⁰ Although it seems that the Chambre of Commerce in Rouen had been active in Paris for some time in support of Laffitte and Blount, serious lobbying by LeHavre and Dieppe began only after parliament reconvened in December. Early in January 1840 LeHavre re-activated its railway committee, and within a month it sent a message to Dufaure, pressing once again for construction of the plateau route and its immediate continuation all the way to LeHavre; to avoid another failure, the committee also insisted that the State should finance and build the line.¹¹ At the same time the Municipal Council of Rouen wrote to Dufaure asking him to give the new company his fullest support.¹² As the contest came closer to its conclusion, lobbying became more intense, and upon receiving reports from the L.S.W.R. general meeting in February, the railway committee in LeHavre once more decided to send delegates to Paris.¹³

As in 1837 and 1838, LeHavre was forced onto the defensive, but this time with even fewer weapons to hand. Extension of the railway to LeHavre was of course very important, if not vital to the town's economy, and the havrais still believed that the only economical means of doing this was a plateau line. They did not accept the conclusion reached by the Ponts et Chaussées in 1838 that an extension of the valley line to LeHavre was feasible. Since after the collapse of Chouquet, Lebobe et Cie they lacked any way of building the plateau line themselves, their only resource was simply to prevent Laffitte and Blount from building one by the valley. They refused to believe the reports of agreement between Dufaure and Laffitte and Blount, and when on the 1st of March comte Jaubert was appointed Minister of Public Works in the new Thiers Ministry, they were greatly encouraged. "Nous avons dans M. Jaubert," wrote Clerc, one of the delegates, "un juste appréciateur des plateaux".¹⁴ With Jaubert as Minister they trusted that success for Laffitte and Blount would be impossible. Jaubert being a convinced advocate of the plateau route, it was thought unlikely that he would give any financial aid to a project for the valley. Since Laffitte and Blount could not manage without assistance from the State, they would be forced to withdraw. By continual lobbying of Jaubert, Thiers, and other influential deputies, the delegates Clerc and Delaroche, and Mermillod their deputy, hoped to hold Jaubert to the plateau and defeat Laffitte and Blount.

Negotiations between Jaubert and the prospective new company however, had soon progressed far beyond the ability of LeHavre to affect their outcome. Jaubert was indeed an advocate of the plateau, but other issues weighed far more heavily in his mind than this. Serious discussion of railways had been going on for more than five years, and very little had been accomplished; the most wide-spread attitude was well summarized in a few words by Michel Chevalier: "il faut à tout prix sortir de la honteuse inaction où nous sommes."¹⁵ A plateau line might be preferable in the long run, but in the Minister's words, "une compagnie (existe) et...on ne (peut) priver plus longtemps la 3ième ville du Royaume d'un chemin de fer."¹⁶ For several reasons therefore, Laffitte and Blount received a sympathetic hearing from the new Ministry. They appeared to have solid financial

backing and the technical competence to go ahead quickly with the project; Jaubert was entirely reassured on these points by Guizot, the Ambassador in London,¹⁷ and by several meetings with the company's British and French promoters. The participation of British capital was another large attraction. Although Jaubert did not at first accept the agreement reached with Dufaure, he was forced eventually to come round to similar terms. Negotiations went on from March to May with interventions from several directions. Guizot wrote on behalf of the British promoters, warning that without certain concessions, "you will have no concurrence from the English capitalists, and...this great affair will break down once more."¹⁸ The city of Rouen too kept up its strong lobby, and suggestions were made, and later acted upon, that financial aid be given to the company by the city.¹⁹ At first Jaubert refused to grant the extra 10 MF promised by Dufaure, except on condition that it be used for construction of an extension to LeHavre. The company seems however, to have insisted, as it later stated to the Chambre of Peers, that such an enterprise "aurait paru trop colossale, et n'aurait pu attirer aussi bien les capitaux, dont la masse devait être plus grande, et dont la confiance aurait diminuée."²⁰ As a second best, the Minister suggested that in order to facilitate eventual extension to LeHavre, the company should build a branch from Pont de l'Arche to Beauvoisine, but he was soon forced to retreat from this position as well. A final agreement including provisions for financial assistance, was reached on the 17th of May 1840.²¹ Approximately equal proportions of the company's total capital would be obtained from the State, from private shareholders in France and from private shareholders in Great Britain. Hearing a few days earlier from Casimir de l'Espée, deputy from the Meurthe and a leader of the company, that an agreement was imminent, the havrais were very alarmed. To prevent such an agreement, which they said would be "une sorte de haute trahison contre les vraies intérêts de l'état et du pays",²² their deputy Mermillod organized a last round of appointments, with Jaubert and Thiers at the top of his list. Even Leboe, who seems to have been trying to revive his company, was invited along in a desperate attempt to offer an alternative.

Jaubert however, was determined not to let this project fall victim to local rivalry and the old contest of valley versus

plateau. Little more than a week after agreement had been reached with Laffitte and Blount therefore, he submitted a projet de loi to the Chambre of Deputies.²³ It was voted through both chambres with only minor delays and one important amendment, being proclaimed law on the 15th of July 1840.²⁴ Deputies and delegates from LeHavre and Dieppe attempted to defeat the bill, but without success. At first they demanded its withdrawal, and later counted on procedural delays to prevent its passage during the 1840 session. Committees of both chambres were concerned to obtain guarantees that the line would be extended to LeHavre (and the efforts of LeHavre ensured that this point was given full attention), but they were satisfied by assurances from the Minister that adequate guarantees existed. Laffitte and Blount would be compelled by Article 9 of the projet de loi to finance half the cost of crossing Rouen as far as Deville, and the Minister promised that every effort would be made to start the extension to LeHavre within the next year.

The Paris-to-Rouen railway bill was amended in only one important respect, that affecting the method of financial assistance from the State. The question of how the State might help in financing private railway companies had once again assumed great importance during 1839. The problems faced by Chouquet, Lebobe et Cie had not of course been unique, and several other companies also found themselves unable to obtain all the capital they needed from the private capital market. By 1840 there was little opposition to the view that railways should be left primarily to private enterprise, though some, like Jaubert, came to this conclusion only reluctantly. Although "partisan en principe de l'exécution par l'Etat", he stated in 1840, "c'est sans aucune arrière-pensée que...je donne les mains à l'intervention large de l'industrie privée...."²⁵ There was equally little question however, that private companies would need substantial assistance from the State. To determine how best this might be given, Dufaure had appointed a special commission at the end of the 1839 session of parliament.²⁶ Comte Jaubert had been one of its members.

The method of State assistance proposed in the projet de loi for the Paris-to-Rouen had been arrived at only after considerable negotiation. Four methods of assistance had been

discussed generally during the 1830s, direct subventions, guarantees of interest, simple loans and subscriptions of equity. Laffitte and Blount tried initially to obtain a guarantee of three per cent interest,²⁷ but when they received an unfavourable response seem quickly to have dropped this idea. On the advice of the special commission, Dufaure had at first suggested that the State contribute its promised one-third of the company's capital as a loan. This would certainly have been the simplest way, and several other companies received loans from the State totalling over 37 MF in 1839 and 1840. Laffitte and Blount however, refused this offer. They replied that they would prefer direct equity participation, perhaps thinking this would add more to their company's credit.²⁸ Though there was no precedent for this type of assistance, the commission was not averse to it and had recommended it for the Paris-to-Orléans. The compromise eventually reached for the Paris-to-Rouen, and contained in the projet de loi, was for a combination of two methods. Of the company's capital of 36 MF, Jaubert agreed that the State would buy 14,000 shares (with a total par value of 7 MF), and lend another 7 MF at four per cent, repayable in thirty years. On its equity the State would receive a return of up to four per cent, but only after all other shareholders had first received the same amount. The State would be represented in the company by a special commissioner, who would have only 100 votes in General Meetings but nothing more than a deliberative voice on the Board of Directors.

This arrangement was not accepted by the Chambre of Deputies. A committee of the Chambre nominated to examine the bill found that it provided the State too small a return and too small a voice on behalf of its large equity. Furthermore, the determination of total profits, affecting the amount of return to the State on its equity, would involve close government scrutiny of the company's affairs. The committee believed, it stated, that "l'état ne saurait sans inconvénient intervenir dans l'administration d'intérêts privés...."²⁹ At the suggestion of the committee and with the Minister's acquiescence, the Chambre passed a law in which the State's entire contribution of 14 MF was in the form of a loan, but at only three per cent instead of four per cent. This change to a loan for the full amount

would mean a permanent annual interest charge on the company's revenues of 420,000 F instead of only 280,000 F, but a loan would be more advantageous if in future its profits exceeded about four per cent. It could be a considerable burden however, if they ever went much below that. The return to shareholders of the Paris-to-St.-Germain railway had averaged about seven per cent between 1838 and 1840,³⁰ and as the promoters of the Paris-to-Rouen were expecting an equally high return on capital, they were confident that their shareholders would accept these new terms. The changes were in fact easily ratified at the first General Meeting held on the 30th of July 1840.³¹

Subscriptions for the 72,000 stock options issued by the company at 500 F each had sold well both in France and Great Britain. Applications for them were received in France at the offices of Jacques Laffitte et Cie and Charles Laffitte, Blount et Cie, and within a month after agreement was reached with the Minister, more than nine-tenths of them had been subscribed. By mid-June according to Jacques Laffitte,³² about 33,000 of the 36,000 options (promesses d'actions) available for sale in France had been sold, to some 1,227 subscribers. The distribution of these options was quite similar to the distribution of shares in Chouquet, Leboe et Cie; somewhat fewer than half, valued at just under 6.6 MF, went to small subscribers with an average of about ten each, while the remainder went to a very small group of bankers and other wealthy investors. Six of these held 200 or more shares, and eighteen held more than 100. Laffitte also reported that over 4,800 shares had been sold outside Paris, about thirteen per cent of the total available in France. 2,000 shares worth one million francs, were sold in Rouen, with the help of a four per cent guarantee of interest from the city council for the first ten years of operation.³³

The sale of options in Great Britain had also been fairly brisk, and one reader of the Railway Times reported from Manchester that all the options available there had been subscribed even before a prospectus had been seen.³⁴ The 36,000 options offered in Great Britain were taken up by a far more concentrated group of investors than in France; there were only 350 subscribers in all, who were owners on average of over 100 options each. Easthope, Moss and Chaplin for example, are reported

to have taken 1,783, 1,145 and 1,000 respectively.³⁵ These British investors were confident of getting a large return on their shares, and apparently less concerned with risk than French investors. In February 1840 William Reed had estimated that the railway's annual revenues would exceed a million pounds. A more detailed estimate of potential revenues was carried out in the summer of 1840 and showed total potential revenues of over £676,000, the equivalent of almost 17 MF.³⁶ No estimate was made of operating expenses, but except for the cost of fuel, it was thought they would be less than in England.

The contribution by British capital, and later by British technique, though possibly not essential to this company's success, were certainly very valuable to it. The State could not have been expected to provide loans or other financial assistance sufficient to replace the amount obtained in Great Britain, and without this foreign participation the Paris-to-Rouen probably could not have been built at this time. Indeed, the pace of railway construction during all of the 1840s, to which British capital contributed very substantially, might have been considerably slowed without it. For this reason the government and the business community, with some exceptions, welcomed the British intervention. "J'éprouve une vive satisfaction", wrote Jaubert to Guizot late in May,³⁷

de voir enfin en bon train d'exécution une Entreprise de cette importance; le fait de l'alliance des capitaux anglais aux nôtres est considerable, et du meilleur augure pour le développement de nos grands travaux publics.

Both the Chambre of Deputies and the Chambre of Peers expressed the same satisfaction in seeing "des capitaux anglais venir solder du travail français".³⁸ It was just a week before the signing of the secret Treaty of London on the 15th of July 1840, that a committee of the Peers wrote,³⁹

cette union des capitaux de la France et de l'Angleterre, pour concourir à une entreprise qui doit rendre plus intimes les relations commerciales des deux pays, est d'un heureux augure pour la continuation de cette alliance qui fait marcher ces deux grandes nations, en prêtant un mutuel appui, à la tête de la civilisation, et qui en assure le progrès en consolidant la paix du monde.

Even after the Treaty of London had become known to all, and despite the diplomatic affront it gave to France, the government of Thiers did all it could to facilitate British participation. The 'caution' deposit of ten per cent of the capital subscribed

in Great Britain was allowed to be deposited in the Bank of England, and a generous time limit set for its eventual transfer to France. Jaubert feared that an aggravation of international tension would cut short the enterprise, and remarked to Guizot,⁴⁰

confidentielllement, que les actionnaires français que j'ai vus ne serait pas fâchés d'être nantis de cette garantie.... Quel dommage si le développement de prospérité qui se manifeste partout en France venait à être arrêté.

Even while Thiers publicly threatened war, the British were assured by Guizot and Jaubert that their investment would be safe. The British stayed in, the enterprise continued, and by the spring of 1841 construction was underway.

Extending the Line to LeHavre and Dieppe. It had long been known that building the line from Rouen to LeHavre would be very costly. Since 1837 it had been agreed that to continue through the valley all the way to LeHavre was impractical, and that beyond Rouen there was no choice but to go by the plateau. However, this would require long tunnels and viaducts to avoid the very steep gradients and deep river valleys just west of Rouen. It was evident that the cost of building each kilometre of line would be higher than for the Paris-to-Rouen. At the same time it was thought likely the line would earn less revenue. The obvious question then was would there be sufficient net revenue to provide an attractive rate of return to investors? Many people in LeHavre feared that there would not and doubted that sufficient funds could be attracted to finance the project. Before 1840 they had hoped that by building a line all the way from Paris to LeHavre as a single project the high profits expected from the Paris-to-Rouen segment would help to attract the finance capital needed to build the much less remunerative segment from Rouen to LeHavre. Now this line would be forced to depend upon its own resources.

Even before legislation had been enacted for the Paris-to-Rouen, the representatives of LeHavre had begun to explore means by which it could be extended to the sea. The means at their disposal were very limited, but they were fully used. On the 13th of July Clerc of the Chambre of Commerce met with Jaubert, but was told that every other means must first be exhausted before the State could consider building the line. Clerc was not optimistic. He also spoke to both Rothschild and the Banque André et Cottier and was forced to conclude that "les capitalistes et les banquiers ont la plus mauvaise opinion du chemin de Rouen

au Havre."⁴¹ The Chambre of Commerce and the City council were at a loss as to how any commercial company could be formed.⁴² Their only recourse was to urge the Minister to compel the Paris-to-Rouen company to extend its line to LeHavre.⁴³ A new government under the presidency of Marshall Soult came into office late in the summer, but it maintained the non-committal policy of its predecessor, and in any case was preoccupied much of the time with other matters. Therefore little progress was made by LeHavre in 1841, though the municipal council voted 20,000 F to pay for further engineering studies, and promised a contribution of 500,000 F to any company undertaking to build the line.⁴⁴

Success came in 1842. With financing and construction of the Paris-to-Rouen well in hand, its directors decided to form another company to build the extension to LeHavre. It was likely to add substantially to their line's traffic by connecting it directly to the port at LeHavre, thus avoiding at the source any 'leakage' of traffic onto river transport. Charles Laffitte went to LeHavre on the 5th of March to announce the directors' intention,⁴⁵ and by the end of April negotiations with the government for a concession and for financial aid had been completed. To secure a lower tariff on the railway, the City of LeHavre was forced to offer a guarantee of interest of four per cent on the shares subscribed by its citizens, and a one million franc operating subsidy spread over ten years.⁴⁶ To compete for the growing transit trade, LeHavre considered it essential to have as low as possible a tariff. The City of LeHavre also agreed with Laffitte to obtain subscriptions for at least half the share capital to be offered in France.⁴⁷

Financial assistance was also forthcoming from the State. Earlier in the session of 1842, the government had proposed what it hoped would become a general solution to the problem of State aid to railway financing. Briefly its proposal was that the State should finance the roadbed and all structures like bridges and tunnels, while private companies would provide the rails and rolling stock. This formula received enthusiastic support from the Chambres, and was to be widely used in coming years. Some thought it should be used for the Rouen-to-LeHavre, but the government preferred to keep the form of assistance to this line consistent with that to its affiliate between Rouen and Paris; the duration of the concessions of these two lines,

and later of the extension to Dieppe, were also made conterminous. To ensure a rate of return acceptable to investors, the amount of State aid had to be substantial, greater proportionately than for most other lines. The Ponts et Chaussées had estimated that the line would cost about 35 MF, including about 5 MF for half the crossing of Rouen, from Sotteville to Deville. Toward this, the government agreed to contribute a loan of 10 MF and a free grant of 8 MF.⁴⁸ Although the committee of the Chambre of Deputies appointed to examine the bill hesitated to recommend acceptance of such a large subsidy, it found that even with it, the return on share capital was likely to be no more than about three per cent per year, and it was forced in the end to acquiesce.⁴⁹ They estimated that in addition to 8 MF in subvention, the State was effectively contributing a further 3.4 MF in foregone and delayed interest. With the committee's reluctant recommendation, the law of concession was passed easily and was proclaimed in June 1842.⁵⁰

Perhaps owing to the low rate of return expected, it took some months to obtain the necessary number of subscriptions to share capital. The company was formed early in May but it was December before all capital had been subscribed.⁵¹ The company was fortunate that confidence in railway investments was growing at this time and that there was a receptive market for their shares. Shares were first quoted on the Bourse, already at par, on the 8th of March 1843,⁵² and were at the same time in high demand and rising in price on the Liverpool Exchange.⁵³ The original subscription of 20 MF share capital was divided almost equally between 167 residents of Great Britain and 835 residents of France. As the City of LeHavre had promised, its residents took up half the offering in France; 277 residents of LeHavre subscribed for 9,939 shares worth 4,969,500 F, of which one-tenth had to be paid immediately.⁵⁴ Many of these shares may soon have been sold — there was a good market for them — but it is evident that LeHavre made an important contribution to the launching of its railway.

It was not until the summer of 1845, two years later, when construction was well underway on the extension to LeHavre that a company was formed to build a line to Dieppe. Over a period of more than a year several groups were formed to raise funds for

this purpose, and eventually found ways to concert their efforts into a single company. This phenomenon of several companies being formed to bid for the concession of one railway line was very common during the so-called 'railway mania' of the mid-1840s. From early in 1843, the owners of the Rouen-to-LeHavre had been discussing means by which an agreement could be made for common use of rolling stock on lines to Dieppe, Fécamp and LeHavre. However, the first news of anything like a company being formed appeared only in July 1844, when a group of British capitalists referred to as Scott and Company were reported to have available 15 MF for a railway to Dieppe.⁵⁵ In January 1845 a group of British and French capitalists, referred to both as the Compagnie Seillière and Smith and Company, were reported to have available 12.5 MF and considerable participation by various Paris banks,⁵⁶ and some time later this company merged its resources with those of several people involved in the Rouen-to-LeHavre railway.⁵⁷ Over the following months subscribers were recruited to this company, the list being closed on the 5th of May 1845. One month later, Dumon, the Minister of Public Works, introduced a projet de loi for a railway to Dieppe and to Fécamp. During the debate which followed, a third company which had been formed in February by comte Louis de Sparre and a group of French and British capitalists,⁵⁸ merged with Seillière and his associates, forming an enlarged company with a total equity of 18 MF.⁵⁹ The law was passed and promulgated on the 19th of August,⁶⁰ and an agreement of concession signed with the Minister in September.⁶¹ This company received no financial assistance from the State. Its founders were very confident in its financial and commercial viability, and subscriptions for the total amount of capital required were easily obtained. As in the case of LeHavre, although the majority of the company's capital was subscribed in Paris, local residents in Dieppe also contributed substantially, as did a number of investors in Great Britain. Of the 36,000 shares of 500 F each, about 25,000 were subscribed in Paris, 5,500 in Great Britain, 2,500 in Rouen and 2,000 in Dieppe.⁶²

Building the Railway from Paris to the Sea.

Building the railway from Paris to Rouen, and then on to LeHavre and Dieppe was a complex task. It was a task which required not only a considerable degree of engineering and organizational skill, but also careful financial management. All three

companies fell victims in varying degrees to the vagaries of politics and the economy, forces which they merely had to contend with and could do little to control. Construction of the Seine railways spanned the whole decade from 1841 to 1850. Work began on the Paris-to-Rouen in the spring of 1841 and was completed on the Rouen-to-Dieppe early in 1850. During these years the three companies ran the full gamut of recession, 'railway mania', financial crisis and revolution, but unlike several others, they all survived the ordeal. In each company there was a two-fold division of duties and responsibilities. The conseil d'administration (Board of Directors) determined over-all policy and ensured a steady flow of funds to the builders, while the chief engineer planned the railway line and hired and supervised a contractor to build it. As will become evident, there was a large element of British influence exercised in both these areas.

Eleven directors of the Paris-to-Rouen company had been named in the company's charter. Four of them were British residents, all with considerable previous experience in railway management. These were Sir John Easthope and William Chaplin, both directors of the London and Southwestern Railway, John Moss, a director of the Grand Junction Railway, and Charles Laurence, a director for ten years of the well-known Liverpool and Manchester Railway. Maintaining the flow of funds from 'calls' made in Great Britain was their chief responsibility, and although they were kept au courant, closer supervision of management was exercised by the seven directors resident in France, who met daily.⁶³ None of these had much previous experience with railways. They were Jacques Laffitte and his nephew Charles Laffitte, Edward Blount, baron Casimir de l'Espée and viscomte Alban de Villeneuve-Bargemont, deputies for the Meurthe and the Nord, comte Charles de Kersaint, also a director of the Compagnie de Saint-Gobain, and viscomte Denys Benoist d'Azy, a prominent maitre de forges from the Allier.⁶⁴ The company's general manager was Adolphe Thibaudeau, who it may be recalled had been involved in the maritime canal company, and who played a considerable part in the negotiations in 1839 and 1840 with the government. He had spent several years in England as correspondent for the liberal newspaper Le National.⁶⁵ The company's other two senior executives both came from the London and Southwestern

Railway, William Reed the company's secretary, who later became the twelfth director,⁶⁶ and Joseph Locke the chief engineer.

Many of these same men had leading roles in the other two smaller companies. In this gradually constructed edifice of railways in the Seine valley, the Paris-to-Rouen was the cornerstone. To ensure that overlapping sources of finance capital and connecting routes were matched by some degree of co-operation in management, there were several common directors. Overlapping control was greatest with the Rouen-to-LeHavre company. Of its ten directors seven were from the parent company, Easthope, Moss, Chaplin, Laurence, Reed, Charles Laffitte and Villeneuve-Bargemont. Three more came new to this company, comte Edmond d'Alton-Shée, a young radical peer, Xavier-Vincent Feulliant, general manager of the *Entreprise générale des omnibus* in Paris, and Claude-Gaspard Dailly, maître de postes for Paris.⁶⁷ Despite the fact that 25 per cent of the share capital had been subscribed in LeHavre, there was no local representative on the conseil d'administration. Overlapping control was much looser with the Rouen-to-Dieppe company. On its conseil d'administration there was only one member from the Paris-to-Rouen, Edward Blount, and one from the Rouen-to-LeHavre, the comte d'Alton-Shée. Alfred-Charles Dailly, another of the directors and an auditeur in the *Conseil d'Etat*, was the son of a member of the latter company's Board. In contrast to the two other companies, the Rouen-to-Dieppe had a large element of local representation on its conseil d'administration; five out of its ten directors had close local connections: Caumont de Jumièges was a member of the Conseil d'Arrondissement of Rouen and resident of Jumièges, Henry Barbet was mayor and deputy for Rouen, P.-E. Capperon, avocat and Ferdinand Osmont, banker, were both members of the city council of Dieppe, and the Baron Michel de Saint-Albin was a property owner in the arrondissements of Neufchâtel and Dieppe. The remaining two were Florentin-Achille Seillière, a banker, and Anne-Théodore Crétu, who was described in the company's statutes as an "ancien chef de division au Ministère de la Guerre."⁶⁸

This overlapping of directorships was a widespread phenomenon in France at this time, and by this process several large and powerful 'syndicates' were formed. Based upon associations of banking, metallurgical, mining and railway interests, they were the prototypes of their kind in France.⁶⁹ The most

important of them were the 'Talabot Group' with a controlling interest in several large enterprises in the Midi and the Rhône valley, and the 'P-O Group', based upon the Paris-to-Orléans railway. British interests in French railways were concentrated in the Easthope-Chaplin-Moss 'group' which began its activities with the Paris-to-Rouen. Chaplin and Moss became directors also of the Chemin de fer du Nord; Easthope was a director of the Paris-to-Strasbourg and the Orléans-to-Bordeaux. An ally, John Masterman, a London banker, was also a director of the Nord and organizer of companies bidding for the Chemins de fer du Centre and Paris à Lyon. Connected with this group was a firm of British bankers, Denison, Heywood and Kennard, who had large interests in the Nord, Tours-to-Nantes, Paris-to-Strasbourg, Orléans-to-Bordeaux, and Bordeaux-to-Cette railways. Edward Blount is said to have been connected with this group.⁷⁰

Economical construction was the responsibility of the company's engineers. One of the conditions of British financial participation had been British choice of the company's chief engineer.⁷¹ The British had great confidence in their railway engineers, and Joseph Locke was one of the best of them; according to a recent study,⁷² he was "the prototype of the great engineer, soon to be gilded and flattered as the Stephensons never were." He had articulated with George Stephenson at Newcastle and worked on the Liverpool and Manchester Railway in 1830. After other appointments, he had become chief engineer (in charge of construction) on the London and Southwestern Railway in 1838.⁷³ He was an ideal choice for the Paris-to-Rouen, a sound designer who was not given to virtuosity; in the words of a contemporary, "he may be termed the Commercial Engineer, one who made the money go as far as possible." He was not ambitious of expensive and thrilling works."⁷⁴ By the summer of 1840 French companies had completed only about 300 kilometres of railway line, much of it intended only for transport of coal, and hardly 50 kilometres of it in the region of Paris.⁷⁵ French engineers therefore had little experience in building railways, and none in building lines of any length. In 1839 Charles Laffitte had gone to England especially to seek British engineering help, perhaps with an eye to eventual shareholder confidence; but it was with excessive modesty that he stated that in France they were "children in the art of making railways."⁷⁶ Locke visited Paris and the site of

the railway, and found the plans drawn up by the Ponts et Chaussées and those which had been purchased from the old Cie Riant to be entirely satisfactory. Detailed on-site engineering surveys were made in the autumn of 1840, and the first contracts for construction let in February 1841.⁷⁷ As work on one line was finished, equipment and men were moved to the next, so that there was continuous almost uninterrupted activity during a whole decade.

The measures of success for any railway builder were economy and speed of construction. Once the company's capital had been established in line with the estimated cost of construction and equipment, the question was how close could the engineer and his contractor come to completing the railway within the limits of the cost estimate and the anticipated construction time. Higher than expected construction costs would mean that more capital would be needed; longer than expected construction time would mean both higher interest payments to shareholders during construction and a loss of potential operating revenue. Either would mean less income for the railway's shareholders. It should be added that it would be surprising if costs did not exceed estimates, since this had been common experience with canals and with earlier railway projects. Measured against the criterion of speed in construction, the Paris-to-Rouen achieved considerable success; the Rouen-to-LeHavre were not so fortunate. All three companies exceeded their cost estimates, the Rouen-to-Dieppe less than the other two. The consequences were severe only in the case of the Rouen-to-LeHavre. Appendix IV contains capital cost accounts for all three companies.

The eventual cost of building and equipping the Paris-to-Rouen exceeded original estimates by over 20 MF or almost fifty per cent. In the summer of 1840, Locke had estimated that total costs would be 46 MF.⁷⁸ In November 1841, after construction had been underway for six months, he revised this estimate to 52.75 MF.⁷⁹ Excessive costs began to be evident within a year or so of its opening to traffic, and by October 1844, about eighteen months after opening, capital expenditures stood at slightly more than 53 MF. The shareholders were told that at least another 6.2 MF could be foreseen,⁸⁰ which would mean total expenses in excess of capital of about 7.3 MF. The short line

crossing Rouen, financed equally by the Paris-to-Rouen and the Rouen-to-LeHavre further increased excess costs. It had been estimated that this section of line would cost 10 MF, but by 1850 the 5 MF to be contributed by the Paris-to-Rouen company had risen to almost 7 MF. 4 MF of this was financed by a State loan promised in the Act of 1840. By June 1850 when the capital account was closed, total expenses had risen to 66.3 MF, over 500,000 F per kilometre. Original capital had been only 50 MF, augmented by the additional State loan of 4 MF.

Construction of the Rouen-to-LeHavre also cost more than 20 MF in excess of original estimates; proportionally the excess was almost three-fifths. Construction of the 87.35 kilometres of railway to LeHavre began in January 1844, one year after the company had been formed. Considerable delay was experienced in making detailed surveys of the route and in obtaining approval for the plans drawn up. Late in October 1843 a contract was signed with Thomas Brassey and William Mackenzie, who had also built the Paris-to-Rouen, for completion in May 1846.⁸¹ After only two years of construction, by the end of 1845, the company's management saw that there would probably be a large excess of costs over their original estimates. There had been some disagreement, indeed confusion, over the original cost estimates. The government had put the total cost of the line from Deville to LeHavre at 30 MF, with an additional 5 MF for the company's contribution to the crossing of Rouen. The parliamentary committee was forced to admit that expenses worth 4 MF had been omitted from this estimate.⁸² Already this exceeded capital by one million. Locke's own cost estimate at this time moreover, was 48.75 MF, to which he added the possibility of a further 4.75 MF, a total that is, of 53.5 MF.⁸³ In the event, by the end of October 1848, expenditure rose to 57.3 MF, which exceeded the company's original capital by almost 20 MF.

The case of the Rouen-to-Dieppe was somewhat different. The cost of building both lines which it planned, to Dieppe and to Fécamp, had been estimated at just over 18 MF, of which 12.4 MF was for the former.⁸⁴ Owing to difficulty in raising capital the line to Fécamp had to be abandoned, which cost the company just over 150,000 F. Though within a year of opening to traffic capital costs for the line to Dieppe alone had risen to 14 MF,

the company was able to avoid an excess of expenditure over its original capital resources. The shares issued in 1845 had been for 500 F each; when the line to Fécamp was abandoned, these were reduced only to 400 F, which yielded a total of 14.4 MF, more than sufficient to cover all expenses on the line to Dieppe.

The total final capital cost for the three lines was over 137.5 MF, which exceeded original estimates by more than 44 MF, or almost 50 per cent. To explain in any detail why the estimates of experienced engineers were so widely incorrect is impossible. In any case, as other writers have pointed out,⁸⁵ accounting practices at this time were rather primitive, and details are lacking for careful analysis. An approach to an answer however, might be obtained by examining in turn the various elements comprising total capital costs. The second problem, which will be examined later, is the effect these excessive costs had upon the three companies. The areas to be explored are four, the cost of acquiring land, of rails and of rolling stock, and the contractor and his labour force.

The Cost of Land. The least predictable element in railway capital costs was the acquisition of land. It was also one of the most costly. This was not an acute problem for the Paris-to-Rouen company, but for the Rouen-to-LeHavre it caused great difficulties. Despite a system of expropriating private property for the 'public utility' which was designed to favour the railway companies, the Rouen-to-LeHavre was forced to pay very high prices. Owing to problems experienced by the Strasbourg-to-Bâle railway in 1839 and 1840, there had been a new law passed in May 1841 governing expropriation,⁸⁶ which altered the procedure for determining the price to be paid to land owners. Once the land had been designated,⁸⁷ its value was determined by a local jury, from whose membership interested landowners were excluded. Offers were made by the expropriator and counter-proposals submitted by the land-owner. The jury then had to fix an amount which fell between these limits; furthermore, any rise or fall in the value of adjacent land left to the expropriated party had to be taken into account.

For all three companies the cost of land was quite high. The difficulties in acquiring it, owing to the thousands of small parcels to be acquired, were potentially immense. Along

the Paris-to-Rouen for example, the company had to acquire 7,500 parcels of land in 48 communes. The real problems encountered on this line however, were small. By December 1841 three-quarters of the necessary land had been acquired, most of it by private agreement,⁸⁸ and with very few exceptions the price awards made by the local juries were quite reasonable.⁸⁹ This is not to say however, that the cost of land was low, for the railway line passed through a well-populated area and crossed many towns. Total land costs on the Paris-to-Rouen were over 5.6 MF, or about 44,000 F per kilometre, a high figure among railways built at this time.⁹⁰

For the unfortunate Rouen-to-LeHavre company it was almost three times as much. The cost of land on this line had been estimated by the Ponts et Chaussées at only 3 MF and by the company at about 4 MF. Its actual final net cost was almost 10 MF,⁹¹ or just short of 114,000 F per kilometre. There were several reasons for this enormous excess over original estimates. The amount of land needed by the company was much greater than expected; the company's requirement had been estimated at about fifty hectares, but it was eventually compelled to purchase over ninety hectares.⁹² Among these were sixty properties above tunnels which had to be bought "pour échapper aux dépréciations excessives que les experts avaient estimées." The line passed through rich agricultural land and many towns, both large and small, including both Rouen and LeHavre. In the third section of the line, nineteen kilometres between Motteville and Alvimare, the estimate of cost in the avant-projet had been 300,000 F; the final cost was 905,000 F. "Les surfaces de l'avant-projet", stated the Directors to the shareholders,

...sont de 28 à 30 hectares. Notre expropriation comprend 50 hectares 28 ares, dont une très forte partie au centre même des villages de Motteville, de Flamanville, d'Auzouville, Lesneval, de Sainte-Marie-des-Champs et de la ville d'Yvetôt. Nous avons dû acquérir vingt-trois maisons et sept bâtiments, le chemin coupe en deux plusieurs cours de ferme. Pas la moindre trace de ces circonstances si graves ne se rencontre dans l'avant-projet.

The prices of more than half the parcels purchased were contested before juries, and though the juries were reasonable in their valuations, the prices paid were very high. On a section of the line within LeHavre for example, the company offered a total of 682,000 F to expropriated land-owners, they replied with counter-

offers totalling over 2,460,000 F., and the jury awarded a total of 925,000 F. The extra 6 MF paid for land was thirty per cent of the company's total excess over original estimates. The cost of land on the Rouen-to-Dieppe was about 1.8 MF, only 35,500 F per kilometre.

The Cost of Rails. The cost per kilometre for rails and their 'chairs' was almost exactly equal for the Paris-to-Rouen and the Rouen-to-LeHavre. The latter was much more fortunate in this area of costs. For the Paris-to-Rouen, obtaining iron rails in France posed serious problems, both of price and of simple physical access. In 1840 there were only three plants of any size in France capable of making them, LeCreuzot, Alais and Decazeville; their combined output, two-thirds that of the whole country, was only 23,000 tons per year.⁹³ At thirty kilogrammes per linear metre, the Paris-to-Rouen alone would require over 15,000 tons, about half the total national annual capacity, and several other lines including the Paris-to-Orléans were being built at this time. All of these factories furthermore were long distances by road, river and sea transport from the railway construction site. It was possible to place orders for nearly all the required rails for the line by November 1841, but the price was very high, almost double that paid in Great Britain.⁹⁴ In the autumn of 1842 however, the danger arose that completion would be delayed by late delivery of part of the rails. Speaking to shareholders in August 1842, Joseph Locke said⁹⁵ he believed the delay

may have arisen from the increased demand during the last two years for these articles of manufacture, for I believe that great exertions have been made by these manufacturers to ensure the delivery of the full quantity in due time, and the difficulties of navigation which for want of water have arrested vessels in their progress have increased that detention still further....

In the event what was said to have been a fairly "large quantity" of rails and chairs were imported from England.⁹⁶ They were bought for only seven pounds per ton, but transport charges and customs duties added another eight. The total price was therefore little different from what would have been paid in France, about 380 F per ton. Little was added to the company's cost for rails by this need to import, but time was lost, significantly contributing to delaying the opening date by two months to the 1st of May 1843. The total cost for rails on the Paris-to-Rouen

up to October 1844 was 9.3 MF, about 72,400 F per kilometre.

By 1843 when the Rouen-to-LeHavre company was ordering its rails demand for them had grown considerably, although fortunately so had industry's capacity to produce them. Tenders were called for rails and chairs in June 1843,⁹⁷ but it was almost a year later before all had been ordered. The prices paid were between 340 F and 350 F per ton.⁹⁸ By the time the Rouen-to-Dieppe company was ordering its rails the price had again risen to levels higher than in 1841, to 385 F per ton, though in its case delivery dates were promptly met.⁹⁹ A price rise of 40 F per ton meant an increase in cost of about 2,500 F per kilometre. The final cost of rails for the single line of track from Rouen to Dieppe was about 43,000 F per kilometre, almost 2.2 MF in total.

Rolling Stock. To ensure timely supply of an adequate number of locomotives of good design and at a reasonable cost, it was thought necessary by the Paris-to-Rouen company to persuade a locomotive manufacturer to establish a plant at Rouen. An established British manufacturer, William Buddicom, and his partner Allcard, came over to France in 1841, and eventually built most of all three companies' rolling stock. Despite significant early contributions to locomotive technology by Séguin and others, less than half of the locomotives being used in France by 1841 were of French manufacture. There were about five companies in France capable of manufacturing locomotives in 1840, Hallette of Arras, the Compagnie d'Anzin, and J.-J. Meyer, A. Koechlin and Willer Stehelin, all of Alsace.¹⁰⁰ Locke seems to have been fearful that these plants, all at some distance from Paris, would be unable to provide an adequate supply.¹⁰¹ However, although these factories had been quite fully occupied during 1838, 1839 and 1840, during the following two or three years they received no orders at all.¹⁰² In 1840 of course Locke could not have known this would occur. According to the Comité de l'Union des constructeurs, several offers were made by French manufacturers to build locomotives for the Paris-to-Rouen, but the company, according to the Committee's secretary,¹⁰³ "a jusqu'à présent refusé toutes les offres et exprimé l'intention formelle de ne demander aucune partie de son matériel aux ateliers français." It may therefore have been factors other than ability to supply the required locomotives on time which determined Locke

not to place orders with established French manufacturers. None of the plants in France were close to Paris or to Rouen, and transport costs would be high. Furthermore, Locke was unfamiliar with the designers in these plants and consultation with them would have been difficult owing to distance and language. He could have imported them from Great Britain, but although by 1841 the price of locomotives in England had fallen well below that in France, a high tariff would have made importing them expensive.

Buddicom offered an almost ideal alternative. He had a plant at Liverpool and had built locomotives for the Grand Junction Railway; some of them were of the 'Crewe' type, designed by Locke.¹⁰⁴ Not only was Buddicom a good friend of Locke's, but he was also well-known to John Moss, a director of both the Paris-to-Rouen and Grand Junction Railways. In December 1840 Locke wrote to Buddicom complaining that he needed some help in France with locomotives; "if I could only get a d -- d good fellow like you," he wrote,¹⁰⁵ "I should be happy." Soon after this an agreement seems to have been made between them for Buddicom to come over and set up a factory in France. In March Locke gave Buddicom a testimonial letter "for the manufacture of Engines on an improved principle....You need only present it to the proper parties," wrote Locke,¹⁰⁶ "to ensure y^r success in obtaining orders for all engines France will...require." By April Buddicom was in France, and the two men had begun to collaborate in modifying the 'Crewe' engine for use on the Paris-to-Rouen. "Brassey being in France," wrote Locke from England,¹⁰⁷ "you must urge his Men at Waggon to vigorous combat and sweep the field for your more important operations." Later in the summer of 1841 Buddicom took fifty men from his works at Liverpool over to France,¹⁰⁸ and by August 1841 he had begun on a new plant at Les Chartreux (Petit-Quévilly), on the left bank of the Seine at Rouen.¹⁰⁹ Thomas Brassey, the contractor, took part in the enterprise as a shareholder.¹¹⁰

Production of locomotives and other equipment for the Paris-to-Rouen company was soon underway. A first contract was signed for the supply of 40 locomotives, 200 goods wagons, and 120 second and third-class coaches.¹¹¹ M. Arnoux, a coach-builder in Paris, received a contract for 36 first-class coaches. Production was reported to be underway by October 1841, with eight

machines under construction. A year later in November 1842 this first group had been finished and were being tested.¹¹² By April 1843 twenty-four locomotives had been delivered, as well as a quantity of other rolling stock and turntables and switches.¹¹³

As would be the case in the other areas of capital cost, expenditures on rolling stock did not end with opening of the line to traffic in May 1843. As freight service was added, and as traffic grew, partly fed from the LeHavre and Dieppe branch lines, more rolling stock had to be added. By September 1843, the Paris-to-Rouen company had spent 3.2 MF on rolling stock; from then until the end of June 1850 (when the capital account was closed), the company spent another 4.3 MF, most of it spread fairly evenly up to the middle of 1848. To reduce the cost both of equipment and of operations, the Paris-to-Rouen and the Rouen-to-LeHavre had agreed to operate their rolling stock jointly.¹¹⁴ The original cost estimates for the Rouen-to-LeHavre had contained only a small provision for rolling stock, as it was thought that both railways could be operated with that owned by the Paris-to-Rouen. Traffic between Rouen and Paris however, soon grew beyond expectations and the Rouen-to-LeHavre was forced by the end of 1848 to spend almost 3.6 MF on its own rolling stock. Some of what it purchased was for use on the Rouen-to-Dieppe, which had none of its own.¹¹⁵

The rolling stock of all three companies continued to be both manufactured and operated on contract by Allcard and Buddicom of Rouen, who were soon among the country's largest builders of railway machinery. According to an article in the Journal des Chemins de Fer in 1846,¹¹⁶ they were the largest producers of locomotives in France at that date. Of the 371 machines which had been produced in France, they are said to have produced 80. Other producers were Derosne et Cail (who produced 75), Meyer et Cie (70), Gouin et Cie (38), François Cavé (35), LeCreuzot (20), La Ciotât (25), Hallette (16), and André Koechlin (12). In the same period, according to another article in the same journal, 665 locomotives had been imported from Great Britain.¹¹⁷ In the early part of 1843, the firm moved to a new plant at Sotteville, the terminus of the Paris-to-Rouen railway; it was essential of course that it be easily accessible to the railway line. Employing about 700 men, many

of them British, it was one of the largest heavy machinery plants in France. It consisted of a group of buildings occupying a site of 6,000 square metres of land; there were sheds for locomotives in service, facilities for repair of coaches, goods wagons, and up to 28 locomotives, and shops for fabrication of boilers and other locomotive components. There were twelve coke-fired furnaces and twenty-two forges.¹¹⁸

Another very large element of capital cost which continued to grow for several years after opening of both lines, to Rouen and to LeHavre, was that for stations. In May 1843, when passenger service on the Paris-to-Rouen began, none of the facilities for goods transport had been completed; many had not even been begun. The many small passenger stations along the line were completed by the end of 1843, but construction of goods facilities went on longer. Three large warehouses were built at Batignolles goods depot at Paris; several more were built at Rouen and at Sotteville. The Rouen-to-LeHavre company built large warehouses in LeHavre next to the port, and provided direct access from the quays to them. The totals spent by these two companies on stations up to about 1850 were, for the Paris-to-Rouen 5.3 MF, and for the Rouen-to-LeHavre, 8.2 MF.

The Contractor and his Labour Force. Building the 'right-of-way', which included the road-bed, tunnels, bridges and viaducts, everything except laying the rails or building stations, comprised a very large proportion of total costs; it was almost forty per cent for the Paris-to-Rouen, more than forty-five per cent for the Rouen-to-LeHavre, and over fifty per cent for the Rouen-to-Dieppe. These works were the responsibility of contractors, who for all three lines were Thomas Brassey and William Mackenzie. The Paris-to-Rouen was divided into ten sections for contracting. When the company tried in 1840 to obtain French contractors for the first of these sections, the prices tendered were much too high; five or six bids were received, the highest at 6.5 MF. Mackenzie and Brassey were persuaded to bid jointly, and were awarded a contract for 3.9 MF¹¹⁹ early in 1841.¹²⁰

The entire task of construction, including laying the rails ('plate-laying'), was given over to the contractors, with the company exercising only general supervision over design and

quality of work. Above the company the Administration des Ponts et Chaussées further supervised the work, to ensure that the standards dictated by the cahier des charges were adhered to. This function was performed by the ingénieurs en chef in each département, until 1846 when a special Service des chemins de fer was established.¹²¹ When disputes arose between the company and the authorities, delays could be considerable, as rapports, procès-verbaux and decisions passed between local engineers and Paris. Needless to say, Joseph Locke preferred the more pragmatic British approach, in which almost all responsibility was given over to the company's engineers on the spot.¹²²

Brassey had experience in building railways in Great Britain, and would live to become one of the century's greatest railway builders.¹²³ He was certainly very skilled, and used every means to reduce costs and construction time to a minimum. The resources available to the contractor building railways in France were very few, and on this his first foreign contract Brassey was forced to take along his own. He had just completed a contract for the London and Southwestern Railway between Basingstoke and Gosport, and he had a considerable force of men and equipment immediately available. Wagons, barrows, shovels and other tools were among the first things to begin arriving at LeHavre, as French tools were said to be inferior and unsuitable for the heavy work ahead.¹²⁴ An attempt was made to import at a low rate of duty about 200 wooden wagons, and agreement was obtained from the Directeur-général des Douanes. However, after great pressure was applied by the Comité des constructeurs, the heavy machinery makers' lobby, this was withdrawn, and they had to be imported over the full tariff for iron machinery.¹²⁵

A very large labour force also came over from Great Britain to France. Lacking efficient mechanical means for excavating and tunnelling, railway building in this early period was very labour-intensive, and large numbers of skilled and unskilled workers were required. There were up to 10,000 engaged at one time on the Paris-to-Rouen,¹²⁶ and up to 5,000 of these were British. There had been little opportunity before 1841 for France to develop an experienced force of railway construction labour, and as recently as 1837 troops had been used to help in building railways near Paris.¹²⁷ As construction progressed

however, a greater proportion of indigenous workers were hired, but a considerable training period was required. Therefore, to obtain the desired speed of construction, experienced British workers were brought in, despite the high wages they demanded and the other disadvantages they imposed. The weakness of French working men was proverbial in England,¹²⁸ and at first they were employed only at the simpler tasks, filling and hauling wagons of earth. They were paid only half the wages received by the British navvies, from two to two and a half francs per day. This was better than local agricultural wages of about 1F.80, and not far below the average amongst industrial wages in early 1841.¹²⁹ French workers therefore were easily hired. They and the British navvies were soon joined also by workers of half a dozen other nationalities, Germans, Belgians, Piedmontese, Dutch, Spaniards, Poles and even Portuguese.¹³⁰ With time local workers went on to the more arduous jobs, but although British labourers became progressively less numerous, they were retained in a number of skilled trades, which seem to have been in short supply in France. Tunnellers, masons and bricklayers in particular continued to be brought over from England.¹³¹

Deployment and supervision of 10,000 men was a task requiring some skill and organization. In Great Britain this had been done by a system of multiple contracts and sub-contracts, which facilitated specialization and removed the main contractor from day-to-day detail. On the Paris-to-Rouen however, all but one of the ten contracts were made with Mackenzie and Brassey; the bridge at Oissel was contracted to a M. Colne, but the work is said to have lagged behind schedule, and according to one of the company's directors, it had to be finished by the company.¹³² Of sub-contracting too there was very little in France, for in the words of Brassey,¹³³ "we cannot find people to undertake" it. Most of the supervision therefore fell to the main contractor. Brassey set up his headquarters at Rouen in 1841, and constantly travelled up and down the line. He had agents at all the major construction sites, as well as twenty resident engineers (most of whom were French).¹³⁴ Men were supervised in groups of about twenty by 'gangers'. The real work units were 'butty gangs' of ten or so men, who were often hired as a group to perform particular tasks for an amount agreed upon in advance.¹³⁵

In this way every effort was made to encourage speed and to control the unit costs of construction. British navvies, though they were noted for their heavy drinking and for taking time off to recover from its effects, were also noted for their very hard and fast work. Methods were devised by them to speed the work of excavation. For example, British workers dispensed with 'spoil banks', taking earth directly from cut to fill by laying out temporary rails along which wagons were pulled by horses.¹³⁶

A saving in time and perhaps also in expense was effected on the Rouen-to-LeHavre line by the use of large excavating machinery. The large steam-driven excavating machine was an American invention, which had first been put to work in France on the railway from Paris to the Belgian frontier.¹³⁷ It had already been used on railways in the United States, Great Britain and Russia.¹³⁸ One of these machines could do the work of 95 men, and they effected a considerable reduction in the unit cost of excavating a yard of earth; a cubic yard of earth cost a minimum of OF.28 to excavate by hand, and about OF.11 by machine.¹³⁹ The machine was operated by two men and required six more to draw away the loose earth. Six of these machines were hired from their American owners, Cochrane and Co., and four were put to work at Bondeville and Houpeville, near Rouen in July 1844.¹⁴⁰ It is difficult to estimate their effect in reducing the total number of labourers required, though there does seem to have been considerably fewer labourers at work on the Rouen-to-LeHavre than there had been on the Paris-to-Rouen.

There were strong motives other than direct costs of excavation for reducing the contractor's dependence upon manual labour, and especially upon foreign labour. The men had to be housed, cared for or compensated in case of accidents, their children given some form of education, and even given relief during the winter months when construction work slowed down. On these lines housing seems not to have been a great problem, as billets were easily obtained for British and other foreign workers, while the local French labourers simply lived at home.¹⁴¹ Rudimentary medical care was provided on all three lines by one doctor and several assistants. Accidents were frequent, and under French law (unlike British) the contractor was fully

responsible for paying compensation to injured men, even if they were injured by their own carelessness.¹⁴² About 75,000 F was paid out in compensation to workers on the Paris-to-Rouen. Conditions were somewhat better for injured workers on the Rouen-to-LeHavre, and a small hospital was built for one section of line.¹⁴³ Some of the workers from Great Britain brought families with them. On the Paris-to-Rouen there were no schools provided, but this also changed on the Rouen-to-LeHavre. At least three schools accommodating over 500 children were opened at Rouen, Barentin and Malaunay.¹⁴⁴

Providing relief to unemployed workers was a serious problem, which was greatly aggravated by the presence of so many transient British workers. Unemployment resulted from two causes, seasonal variation in the pace of construction, and many more British workers coming over to France than were required.¹⁴⁵ Unemployment was high in Great Britain, and despite the inability of many British workers to find any work on the railway between Paris and Rouen, they continued to come over to France. The effect of this was felt first of course by the men, and second by Gilbert Gordon, British Consul in LeHavre, whose task it was to help distressed British subjects. He was prevented by Foreign Office and Treasury policy from spending any public funds for this purpose,¹⁴⁶ yet other means could not be found. The crisis eased considerably after 1842, and fortunately for Mr. Gordon an inundation of poverty-stricken British workers did not occur when construction of the Paris-to-Rouen ended. Many stayed on to work on the crossing of Rouen, and later the other two railway lines, while many others are said to have obtained work on the fortifications at Paris.¹⁴⁷ Seasonal unemployment continued however, and Mackenzie and Brassey paid relief to over 300 workers during the winter of 1843-44.¹⁴⁸

The second criterion of success in railway building was speed. Though the Paris-to-Rouen did well in this respect the Rouen-to-LeHavre did not. On the former there were few serious engineering problems encountered. Construction of the line from Aisnières, where it joined the St.-Germain railway, to Sotteville on the left bank of the Seine at Rouen went ahead quickly. The most difficult feats of engineering were four

tunnels, among them the one at Rolleboise which was blasted through 2,600 metres of hard rock, and four bridges. The whole line was completed in two years, a remarkably short time.

(Chouquet, Lebobe et Cie had planned to complete their line in eight years.) The engineering problems to be solved on the Rouen-to-LeHavre were not serious either. However, long delays arose owing to several causes. Carrying out detailed surveys and obtaining Ponts et Chaussées authority to begin construction took many months. Attempts were made to obtain permission to reduce the line's gradient from Rouen up onto the plateau at Barentin. Another long delay was caused by a dispute over the route to be followed near the town of Bolbec. Construction began in January 1844,¹⁴⁹ and continued throughout most of 1844 on the section between Rouen and Barentin.¹⁵⁰ By the end of November 1844, two and a half years after the concession had been granted, the shareholders were expressing concern over the slow progress being made.¹⁵¹

Work had been continuing for another year when disaster struck. In the middle of January 1846, the long, high viaduct at Barentin collapsed. The delay caused by this incident was considerable. The line had been scheduled to open for traffic in June 1846, but this was delayed until March 1847.¹⁵² Immediately after the accident, the Administration began an investigation. The Conseil-général des Ponts et Chaussées appointed Pierre Frissard, who by this time was one of its members, to report back to it on the circumstances and the causes. It was Frissard's opinion that the viaduct had collapsed owing to weakness in the bases of the pillars; they had been built of a shell of stone blocks filled with rubble and mortar which had not set properly.¹⁵³ The Conseil-général decided that the viaduct must be entirely rebuilt with pillars of larger cross-section, and the stone shell filled entirely with brick.¹⁵⁴ Despite the fact that failure had occurred owing to use of materials recommended by Locke, and which Brassey had not liked, Mackenzie and Brassey took upon themselves the entire responsibility for reconstruction.¹⁵⁵ Rebuilding seems to have been underway by the middle of April 1846, with 600 men working on the new viaduct both night and day,¹⁵⁶ and it was finished in six months. But this was not the end of it. Owing to

considerable public alarm about the safety of the new viaduct and of the two others on this line, the Conseil-général des Ponts et Chaussées decided that the company must carry out a series of strength tests on them; many of the conseillers had at first believed that one of the other two, the viaduct at Malaunay, should also be entirely rebuilt. For one month, during December 1846, the Malaunay viaduct was loaded across its entire length with three metres deep of sand. During January this was also done on the Mirville viaduct, and followed on both by moving tests with rolling stock. The company had originally estimated that the delay would be two months, but by this time it had stretched out to nine. Although the cost of reconstruction fell upon Mackenzie and Brassey, the company suffered an equal burden. The interest paid to shareholders at four per cent over nine months was at least 600,000 F, and the cost of the tests mentioned above was about 50,000 F. There was also a loss of net revenue during these nine months when the line did not operate as had been expected. The total loss to the company was probably over one million francs.

Financing Construction

As Chouquet, Lebobe et Cie had most painfully discovered, there was a great difference between obtaining subscriptions for capital and later obtaining full payment for these subscriptions. Moreover, once payments were received, the cash resources had to be 'stored', safely and economically. Finally, when costs ran over the limits of original capital, more had somehow to be obtained. All of these aspects of financing had potential costs which were reflected in the total capital costs of the three railway lines.

For the Paris-to-Rouen company obtaining payments from its subscribers was easy. Calls were paid up promptly at the prescribed three-month intervals, and up to August 1842 when 32 MF of the total equity capital of 36 MF had been received only 94 shares out of 72,000 had defaulted.¹⁵⁷ In January 1841 the shares of the Paris-to-Rouen company first joined those of seven other railway companies on the Paris Bourse, and began trading somewhat below par.¹⁵⁸ Confidence in the new company's prospects was helped by a rise in the rate of interest paid during construction from three to four per cent,¹⁵⁹ and by the

summer of 1843 its shares had reached 700 F, 200 F above par. Trading was also brisk and prices followed the same course on the exchange at Liverpool.

When the Paris-to-Rouen company's construction costs began to exceed estimates, it became evident that more capital would be required. By October 1844 expenditures had reached 51.8 MF, and further expenditures of almost 9 MF were anticipated. A small part of the excess to date had been covered by the 862,000 F earned as interest on Treasury bonds and bank accounts and in penalties from late payments on calls. For the rest, the company would have preferred to issue 18,000 new shares at 500 F,¹⁶⁰ but was compelled by the Administration to issue a loan instead. Issuing new shares at a par value of 500 F to existing shareholders, when their market price was over 1,000 F would only have added to the fires of speculation. Moreover, since 3 MF of the projected new issues were to cover the possible expense of a branch line to Elbeuf and Louviers which the Administration wished to reserve until concession of a line to Basse-Normandie, the loan was reduced to 6 MF.¹⁶¹ Selling these bonds however, was not so easy as had been anticipated. When the sale was proposed in 1844 the capital market was just entering its most expansive stage, but the investment boom did not last long, and by the autumn of 1845 serious strains were beginning to appear. The demands placed on the capital market during 1845 were enormous. During this year there were eleven railway companies formed with a total capital of 563.5 MF, and of this it was estimated that 105 MF had actually to be paid up during 1845.¹⁶² Very soon after the company's bonds were offered for sale the stock market began to fall, and by January 1846 fewer than two-thirds had been sold.¹⁶³ The causes of this "alerte" in 1845, as Bertrand Gille calls it,¹⁶⁴ seem to have been very similar to those in 1838, excessive long-term investment which caused a shortage of short-term funds, followed by liquidation of long-term commitments. Moreover, as the first payments came due on the huge mass of subscriptions taken up during the year, many investors had to make a choice and dispose of some shares. There was certainly much less room for new issues coming on the market. British shareholders were among the first to liquidate,¹⁶⁵ which made the Seine railways with their high proportion of British shareholders very vulnerable.

By this time the Rouen-to-LeHavre company was also in need of extra funds. At a special meeting of shareholders on the 10th of December 1845 the conseil d'administration explained that 8 to 10 MF would be required, and that 8 MF of a 10 MF bond issue would be put on sale.¹⁶⁶ The interest rate to be paid was set at the relatively high rate of five per cent, for as the directors explained, "les capitaux (sont) plus rares ou plus craintifs, et dans tous les cas plus chers...."

Fortunately during the first half of 1846 the capital market recovered some of its strength, and the company's bonds were all sold by the end of August 1846.¹⁶⁷ While tests were being carried out on the viaducts, considerable help was also obtained from Laffitte and Blount, the company's bankers. The Paris-to-Rouen company was not so fortunate, and it managed to sell only half the remaining third of its bond issue by January 1847.

During 1846 the capital market suffered a relapse, which developed into something much more serious than the "alerte" of 1845. Yet both companies needed still more funds. Since about July 1846 the stock market had been declining, and the Journal des Chemins de Fer first noticed the trend in the second week of August.¹⁶⁸ The fall accelerated through the autumn and by January 1847 share prices stood at 75 per cent of their value nine months earlier. A tighter money market owing to a poor harvest, consequent outflow of gold and a higher commercial discount rate contributed strongly to this.¹⁶⁹ The demands made upon the capital market by railway companies also continued to be very large. It was pointed out by the Journal des Chemins de Fer in November 1846,¹⁷⁰ that over the following nine months 135 MF would come due for payment on railway shares. The total amounts committed to lines under construction, conceded or projected came to more than ten times this sum.¹⁷¹ It was under these conditions both companies went to the market for more funds in January 1847. The Rouen-to-LeHavre issued 5 MF at five per cent¹⁷² while the Paris-to-Rouen decided instead to issue up to 5 MF in short-term securities as an interim measure, and to consolidate these at a more opportune time; by July almost 2 MF had been raised by this means, at an effective interest rate of about four per cent, lower than the going rate on long-term securities. Within the next six months these were consolidated into a long-term bond issue at five per cent, 3.9 MF of

which was sold. The Paris-to-Rouen company was also able to borrow substantially at somewhat lower cost from its operating account;¹⁷³ and of this internal borrowing, almost 1.5 MF was still outstanding by the beginning of 1848.

As the economic crisis deepened through 1847, the companies' needs for additional funds continued. In this respect, these two companies were not unique, for as the prices of iron and other construction materials rose, many companies were being forced to find additional funds. Gille lists four other companies who put a total of 32 MF worth of bonds on the market during the crisis year of 1847.¹⁷⁴ The situation of the Rouen-to-LeHavre company was becoming increasingly worrisome to its management. As traffic grew in the months following the line's opening in March 1847, more funds were needed for additional rolling stock and station facilities. Late in 1847 therefore it was decided to issue another 5 MF in long-term bonds at five per cent. The situation was worrisome because operating revenues and profits had so far been smaller than expected, and the steadily rising amount of debt was imposing a growing burden on these revenues. Should the commercial crisis be aggravated and revenues fall even farther, the burden of fixed interest payments could become intolerable. Paradoxically this parlous state of affairs made the company's bonds easier to sell, for as debt obligations of the company, they offered what appeared to be a more assured return. The capital market was clearly in disarray through 1847; once again the situation is well summarized by Bertrand Gille.¹⁷⁵

Tous les éléments de la crise étaient réunis. Pour retrouver leurs fonds de roulement dangereusement immobilisés, les fabricants devaient vendre les titres qu'ils avaient acquis ou les marchandises qu'ils avaient en stock. Pour payer les versements successifs, les "capitalistes" devaient également arbitrer entre leurs titres. Enfin, comble d'infortune, les Anglais, eux aussi en difficulté, arbitraient automatiquement leurs placements en vendant les titres étrangers, c'est-à-dire surtout les valeurs de chemins de fer français.

Railway share prices continued to fall throughout the year, though the Journal des Chemins de Fer thought it saw a recovery beginning in November.¹⁷⁶ Low profits made investors very wary of Rouen-to-LeHayre shares, and rumours of a rock-fall on the line in the first week of December 1847 caused a drop in the company's stock from 512F.25 to 471F.25¹⁷⁷ It was just this

apprehension over low profits and high risk which made investors eager to buy fixed interest securities, and the new issue of 5 MF was reported to be selling well in the last weeks of December 1847.¹⁷⁸

The growing crisis also had an almost disastrous effect upon the Rouen-to-Dieppe company. Its problem became very similar to that experienced by Chouquet, Lebobe et Cie, inability to realize its subscribed capital. In the first months of 1846, even before any construction on the line had begun, a large number of shares were delinquent in answering the call for payment of the second tenth of subscribed capital. As many of these were owned in Great Britain, legal action was difficult. It was felt also that a defaulters' auction would be unwise, since the price of the company's shares had been falling ever since they were listed on the Bourse in October 1845. It was decided therefore to buy them back instead. 2,045 shares were bought by the company, 1,000 with its own resources and the rest with the contractors' reserve fund. The same thing occurred with the third versement a few months later, and this time the company was forced to sell another 2,000 delinquent shares, at a loss of almost 170,000 F. Though the fourth went more smoothly, it was clear that the company would be unable to realize all of its capital. An obvious remedy would be to postpone building the second branch to Fécamp, and to concentrate all its resources on the more important line to Dieppe. After intervention from the Town of Fécamp however, an approach was made to the government for aid in the form of a guarantee of interest, but when the response to this was negative, the company was forced to fall back upon its first idea. Further large numbers of shareholders failed to pay calls between May 1847 and January 1848.

It was in the following weeks that the full extent of the Rouen-to-LeHavre company's vulnerability and the Rouen-to-Dieppe company's weakness became evident. There seems to have been a growing sense of approaching calamity in France during these first weeks of 1848. During December the Journal des Chemins de Fer complained of the unhealthy attitude of French investors; this financial crisis, it said,¹⁷⁹ was one "comme les

actionnaires français sont seuls capables d'en éprouver....Les porteurs de titres...s'abandonnent si facilement aux plus pueriles appréhensions, prêtant par trop naïvement le flanc à la spéculation." Even the price of rentes was falling, it noted with the prophetic remark, "comme si l'on prévoyait un ébranlement de l'édifice gouvernementale...." Enthusiasm for the Rouen-to-LeHavre company's bonds was short-lived, and it was forced to obtain its funds largely by selling short-term securities at a discount. In this way the company's dangerous financial situation was further aggravated. As the conseil d'administration later told the shareholders,¹⁸⁰

Les banquiers de la société qui négociaient ces valeurs, nous avaient, à divers reprises, avertis des difficultés que cette négociation pourrait rencontrer dans l'avenir, et de l'embarras sérieux dans lequel ils se trouvaient placés, si les renouvellements devenaient impossibles: par ces motifs nous avons reconnu la nécessité d'une prochaine consolidation; mais l'état du crédit public et privé ne nous avait pas permis d'y procéder....

When the financial débâcle of February 1848 occurred the company's whole financial edifice was very badly undermined, though not toppled. Great difficulties were created for the Rouen-to-Dieppe company. Any prospect of recovering much from remaining calls effectively vanished, and when the Bourse reopened late in February the company's shares fell from an already low value of 250 F to little more than 125 F. The resulting lack of cash forced the company to suspend construction,¹⁸² until resources were found to resume work early in May. The company's caution deposit of 170,000 F was refunded by the government; about 250,000 F from the company's portfolio of Treasury bonds was sold (at a loss); a generous credit arrangement was arrived at with Mackenzie and Brassey.

As for the Rouen-to-LeHavre company, its short-term securities could not be renewed, and the Bank of France refused to discount them. A considerable quantity of these were held in fact by the Rouen-to-Dieppe company, which was left unable to redeem them for the cash it badly needed. Laffitte and Blount, the company's bankers, were forced into liquidation early in March, owing the Rouen-to-LeHavre company almost 314,000 F. During March 1848, operating revenues were reduced almost to zero. Moreover, a request to the government for payment

of 500,000 F outstanding on the subvention of 8 MF promised in 1842 went unanswered. Bankruptcy was narrowly averted only because the company's creditors were few in number and willing to wait. All payments both of dividends and of interest on bonds were suspended until the company's short-term debts could be paid off.¹⁸³ All three companies however, managed to survive the crisis and were able to continue their operations into the prosperous 1850s.

PART THREE

Provided with both motive power and track, the railway could begin its operations. The immediate result was competition with road and river-borne transport. The new railway combined speed equal or superior to that of road transport with prices close to those of river transport, and it took traffic from both. Its rivals for passenger transport were almost immediately eliminated. Neither of its rivals for goods however, was so greatly affected. Road transport, despite its very high rates, was able for several years to retain a small part of its former traffic. The operators of river-borne transport lost relatively little of their accustomed traffic; however, competition forced down their rates and their revenues. This loss of revenue was aggravated by an economic crisis in the late 1840s. The role of the State was to act as arbiter and protector, and for the first time since the Old Regime it became involved in economic regulation of transport. The State also retained its leading role in the provision and improvement of waterway infrastructure. As river-borne transport became threatened by competition, the programme begun in the 1830s for canalization of the Seine was accelerated. During the 1850s most of a first stage of this programme was completed. With this and with further innovations, water transport was able to regain some of its lost traffic and revenue.

CHAPTER SEVEN

The First Experience of Competition, 1843 to 1849

The first railway trains ran between Paris and Rouen early in May 1843. In the beginning they carried only passengers, and it was not long before almost all intercity passenger transport by other means had been eliminated. Serious competition for goods transport began in 1844, and considerable quantities of some types of goods were taken from both road and water-borne transport. However, it was not until 1847 when the railway was extended to LeHavre that it began to make large inroads upon the traditional staples of water transport, such as wines and spirits. This was the first year in which railway traffic from Rouen to Paris exceeded that on the river. The Paris-to-Rouen railway company consistently returned adequate profits to its shareholders, partly owing to its large passenger revenues. Because the Rouen-to-LeHavre had much smaller revenues from both passengers and goods, and owing to its very high construction costs, it found an adequate level of profit impossible to attain. During the crisis in 1848, when traffic was entirely stopped for a time on both lines, the Rouen-to-LeHavre suffered a loss on its operating account, as well as being in serious difficulty with financing its large debt. The economic crisis which began in 1847 and was greatly aggravated after the journées of February 1848, had an equally serious effect upon the batellerie. However, even by 1849, after suffering the effects of both competition and economic crisis, neither road transport nor the batellerie had been eliminated. The latter still carried half of the goods from Rouen to Paris.

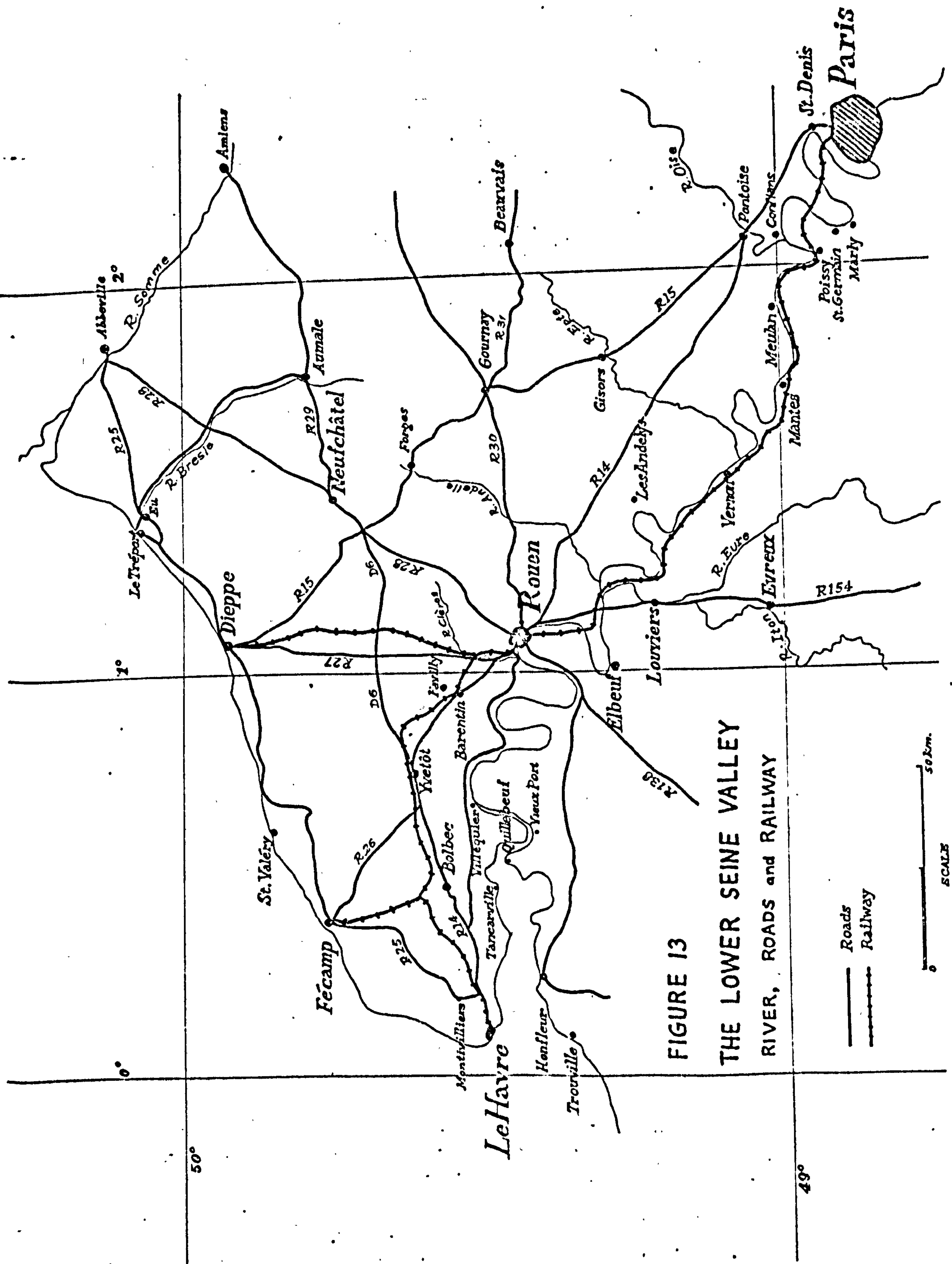
Brief Competition for Passengers.

When it first opened for service on the 9th of May 1843, the new railway's activities were almost entirely confined to the carriage of passengers. Therefore the first battle in the competitive struggle between the railway and its longer established rivals was fought over passengers. Though the battle was short

and the outcome easily foreseen, its results were important. The virtual monopoly soon won by the railway provided one of the main strong-points from which it could subsequently attack its other rivals for a share of goods traffic. It was a decade since the first passengers had been carried by rail in France, and there was little doubt in anyone's mind that all but an insignificant part of inter-city passenger transport would quickly be taken over by railways wherever they were built. Their combination of speed and relative comfort was clearly superior to either of their potential competitors using the roads and waterways. This almost universal admission of the railway's superiority was epitomized by the reaction of a royal princess upon stepping down from her first ride on the new Paris-to-St.-Germain railway in 1837.

"Vraiment", she said, "cela dégoûte de toute autre manière de voyager."¹ There is no doubt that superior speed was its most effective weapon in defeating its rivals. On its inaugural trip from Paris to Rouen, even after making six stops along the way, the train took only four and a half hours from the Gare St.-Lazare to Rouen.² In regular service this was further reduced to only four hours, half the time required by road and one-third that by steamer. The railway's fares moreover compared favourably with those of its rivals. Fares were set only slightly below the maxima permitted by its cahier des charges, 16 F for a first class seat from Paris to Rouen, 13 F for a second class seat, and 10 F for a third.³ These fares gave the railway total superiority over less comfortable road transport. Passengers travelling by diligence were compelled to pay from about 18 F for the poorest seats on the outside 'banquette' to 25 F for the best inside 'coupé' seats.⁴ Steamers though, while easily beaten in speed, were probably no less comfortable than the railway and they retained a slight advantage in price. Steamer fares, which had been 14 F and 10 F for first and second class accommodation in 1840,⁵ had been reduced to only 9 F and 6 F by 1843.⁶

The railway's victory over passenger transport by road was predictably swift and almost complete. It was estimated in 1843⁷ that during the previous year 750,000 passengers had travelled all or part of the way by road between Rouen and Paris; this included both the route d'en haut (Route royale N0. 14 across the plateau) and the less used route d'en bas (N0. 13 through the valley).



About 70,000 of these passengers travelled the whole distance between Paris and Rouen. Within little more than three months an agreement was signed with the two principal passenger carriers, the Messageries royales and the Messageries Laffitte, by which both agreed to cease all passenger transport from Paris to Rouen.⁸ At the same time they agreed to give up their express traffic which went in the same coaches. In future they would act as freight forwarders for the railway, which would charge the same rate for express as they had, about 49 F per ton from Paris to Rouen.⁹ To complete this entente, early in 1844 M. Simons, administrateur of the Messageries royales, filled the place left vacant by Jacques Laffitte on the Board of Directors of the Paris-to-Rouen company.¹⁰ It is not likely however, that all passenger transport by road was ended by this arrangement. It was still necessary to carry passengers to and from towns off the railway line, especially those on the plateau and in the Eure valley, and it is probable that many shorter journeys were still made by road.¹¹

Passenger steamers managed for several months to retain a significant proportion of their former traffic. Before the advent of the railway, these steamers had carried about 300,000 passengers each year all or part of the way between Paris and Rouen, and about one-tenth of these are said to have travelled the whole distance.¹² An article in the Journal des Chemins de Fer in the week following the opening of the railway¹³ reported that the steamer operators had been greatly encouraged by the comparatively high level of passenger fares on the railway. Through the summer of 1843 an average of about 3,500 passengers travelled by steamer,¹⁴ about thirty per cent of the former traffic. The railway's management later estimated that this competition from the steamers cost it about 100,000 F in lost revenue during 1843,¹⁵ and in the following year steps were taken to eliminate it. As with road transport, an agreement was made with the operators of the ETOILES and the DORADES in the spring of 1844 in which these companies agreed to cease carrying any passengers between Pecq and Rouen. However, there was a price which had to be paid. In return the railway company granted them an indemnity of 5,000 F per month for seven months each year for the following three years.¹⁶ If the company's estimate of lost revenue was correct, this was a

cheap price to pay, and it probably gave the steamer operators net revenues very close to those they had been getting during the period of competition. The only losers were the travellers who preferred economy to speed; the cheapest seat on the railway—in uncovered third class carriages—was little less than double the cheapest passage by steamer. Means were soon found by which the railway could also tap this low-price market. On the recommendation of William Reed, who had seen it done on the London and Southwestern, the company began late in the summer of 1844 to attach second and third class coaches to its goods trains; the travel time to Rouen was six to seven hours and the third class fare was six francs, equal to the lowest fare by steamer.¹⁷

The one area of passenger transport in which competition was not eliminated was over the short distance between Paris, Maisons, Poissy and Meulan. Competition here came from two main sources, from river steamers and from the Paris-to-St.-Germain railway, which ran on the same tracks as the Paris-to-Rouen. Owing to higher railway fares and to the relative unimportance of the time difference between modes, water-borne transport still did well over these short distances. It was reported early in 1844¹⁸ that the Paris-to-Rouen railway was getting only about half of the passengers travelling between Paris and Maisons, and only one-quarter of those to Poissy and Meulan. To get more of this traffic, the company considerably lowered its fares between Paris and Mantes, and increased the number of trains between these two points from six to eleven each day in the summer of 1844.¹⁹ Whatever effect this had is unknown.²⁰

The railway had a very successful first year of operation. It carried more than 600,000 passengers and earned gross revenues of over 5 MF.²¹ Operating costs came to only 39 per cent of revenues, and even if track and station maintenance had been taken into account in this year (they still remained the responsibility of the contractors), this figure would still probably have been only about 47 per cent. Passengers were of undisputed economic importance to this and other companies. However, use of the railway continued for many years to be limited to a very small segment of the total population. One might have expected the one-third reduction in fares and a one-half reduction in travel time which they brought about to stimulate many new passenger

journeys. The increase which occurred seems to have been about twenty per cent, and thereafter, as is evident in Figure 14, the rate of growth was very slow. With the passenger market limited by the very low level of incomes earned by the great majority of the population, it is doubtful that except in the first instance when competitors were being eliminated that many more passengers could have been attracted by a reduction in fares. Over the next fifteen years in fact no more than one or two were made. Passenger traffic, unlike goods traffic, was very highly seasonal, and only a small part of it consisted of passengers travelling all the way between Paris and Rouen. By 1845, when almost 970,000 passengers were carried, eighty per cent of them travelled only part of the full distance. After the Rouen-to-LeHavre railway was opened in 1847 very few passengers travelled all the way between Paris and LeHavre; only 8.4 per cent of the passengers riding the line between Rouen and LeHavre originated their journeys east of Rouen. Only ten per cent of the total passengers on the Paris-to-Rouen travelled first class, the remainder being divided equally between second and third classes.²²

Competition in the Transport of Goods.

Although a limited quantity of goods was carried by the railway from about July 1843, full goods service from terminals at Batignolles on the northern edge of Paris and at Sotteville across the Seine from Rouen was not begun until January 1844. Until this time the company had not yet received sufficient rolling stock, and owing to delays in construction and a prolonged dispute with the Paris-to-St.-Germain railway company, with whom the Paris-to-Rouen shared part of its track,²³ the terminal at Batignolles was not ready for use. Even once it had begun goods traffic grew only gradually, for competition for goods from both road and water-borne transport remained much more effective than it had been for passengers. Some vestiges of inter-city goods transport by road remained even in the early 1850s. Water-borne goods transport, though its operators suffered considerably from competition by the railway, was able to survive through the 1840s and into the more prosperous 1850s. Goods transport was much more complex in nature than passenger transport; not only speed and price, but also timetabling, conditions of carriage,

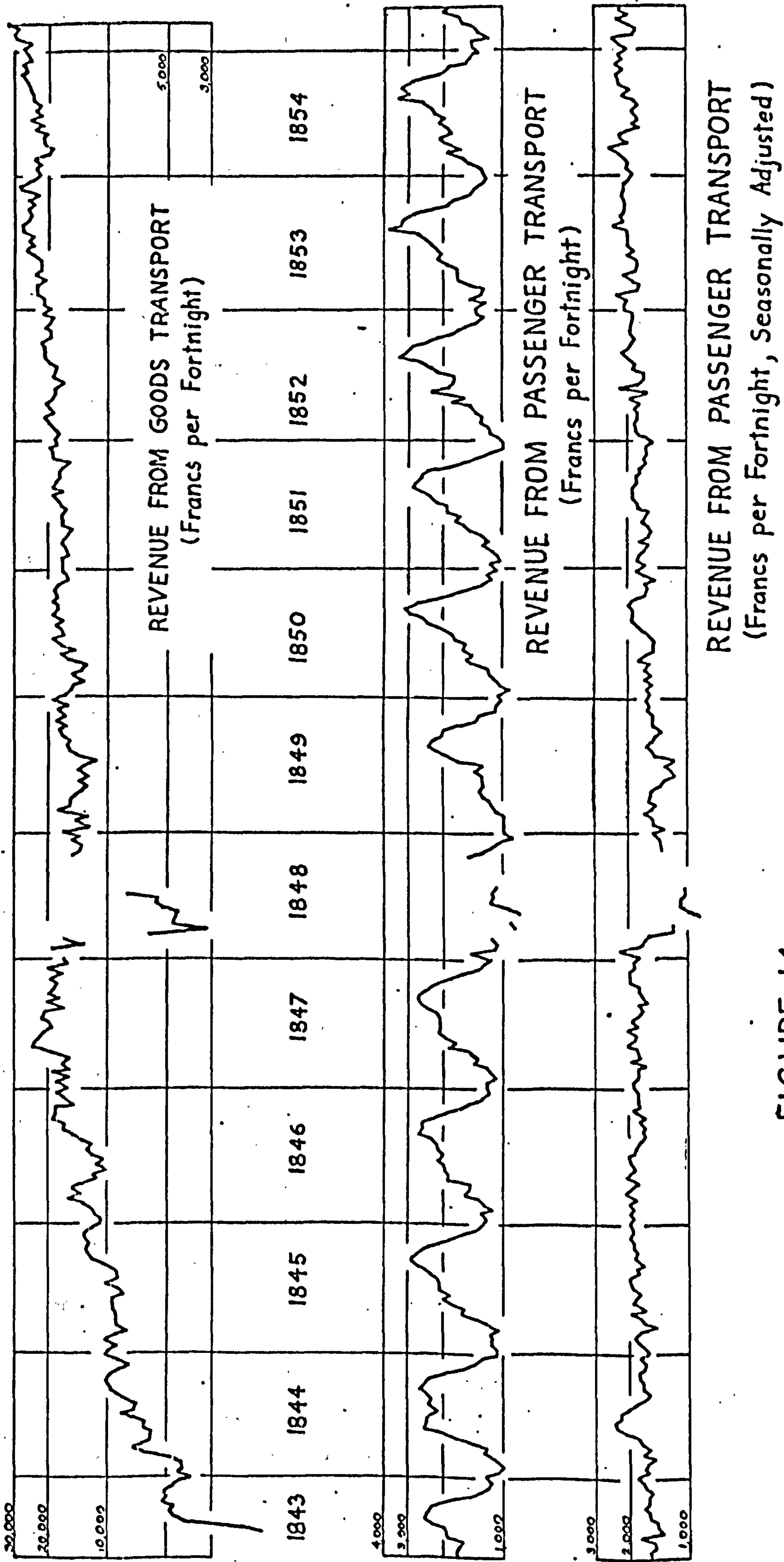


FIGURE 14

PARIS-TO-ROUEN RAILWAY
GOODS and PASSENGER REVENUES (1843-1854)

convenience and other factors helped to determine the distribution of commodities among transport modes. Nevertheless, the railway's principal weapon in the contest for goods traffic was its tariff. Using this weapon however, was not a simple task; competitive and profitable rates had to be determined for each of several hundred commodities, taking into account not only simple considerations of revenue yield and cost (at a time when none of the modern techniques for cost and revenue analysis existed), but also the possible reactions of rivals who might in turn lower some of their own rates. The beginning was especially difficult, when knowledge of these factors was very small. Nor was the company entirely free to set its tariff as it wished; it very quickly learned that the law imposed constraints.

In the beginning the only effective means for determining a goods tariff was to experiment, and beginning in June 1843 the company made several changes in its rates. Unfortunately this brought it into almost immediate conflict with the Administration, which considered such action to be illegal. The conflict however, was short-lived. The Administration seemed anxious that the benefits from lower transport costs should not be limited by undue constraints upon the railway companies which would prevent them from lowering their rates, and it quickly developed a very sympathetic and permissive regulatory stance toward them. The Administration's experience in economic regulation of transport was slight and it seems at first to have been unsure of the means it should adopt; since the Old Regime none of the traditional means of transport had been subject to such regulation, and until 1843 there seemed to be no need for any administrative regulation of the railways. There were by this time moreover, only the most slender of legal bases for a system of economic regulation, nothing more indeed than the statutory cahiers des charges for each railway company. There was no general legislation setting out a system of economic regulation, and the applicability of existing Codes seems to have been quite unclear. The Administration's power to exercise some control over the railways in their commercial affairs sprang from the nature of the 'concession'. Unlike the railways of Great Britain and elsewhere, those of France were never granted clear title to the rights-of-way they occupied; once expropriated these remained part of the public

domain. The concessions by which companies were granted a protected monopoly to exploit certain lines of railway were only contracts between them and the State. In return for their undertaking to build and operate these lines of railway as common carriers, the companies were given the right to charge rates of carriage up to certain maxima, which were set out in the cahiers des charges.²⁴ Goods and passengers were each divided into three classes, roughly on the basis of their value, and three maximum rates of carriage prescribed. Although it was stated in Article 35 of the cahier des charges that "tous changements apportés dans les tarifs devront être homologués par des arrêtés du préfet...", nothing was stated explicitly about homologation, or official publication, of the company's initial tariff. Nor did it explicitly exclude any change in the system of classification.

In attempting to control the company's activities, the central Administration tried at first to work almost entirely through its local agents, the prefects. This worked in most other areas of administration. The prefects however, were naturally very subject to pressure from the vested interests of their locality. Seeing only its competitors behind the prefects therefore, the railway company resisted their attempts at regulation. On the 16th of June 1843 a 'Règlement général de police du chemin de fer de Paris à Rouen' was sent by the Prefect of the Seine-Inférieure to the company,²⁵ requiring that its tariff receive homologation by him before being put into effect. Although the company had already sent two proposed tariffs to the Minister of Public Works, neither had been published and it continued its experimenting, in effect ignoring the authority of the Prefect. When the company failed to comply with the règlement, the Prefect sought instructions from the Minister.²⁶ He soon arrived at an impasse. He was told first to issue a simple procès-verbal de contravention against the company,²⁷ and when this had no effect, an arrêté forbidding the railway to begin any carriage of goods. This also proved ineffective—the fine imposed was only five francs—but when he asked the Minister if he should use physical force against the company, the Prefect was told that he should not.²⁸ In effect therefore he was powerless. In Rouen there was growing discontent with the conduct of the railway company, especially among the commissionnaires de roulage, who were the

first to feel the effects of competition. In July and August five of them sent two petitions to the Prefect and one to the Conseil-général of the Seine-Inférieure,²⁹ complaining of illegal practices by the company and pleading that failure to enforce the law would be fatal to their businesses. In mid-September the Prefect asked the Chambre of Commerce for advice on the subject, but while they stated their objections to several points in the company's proposed tariff, particularly its departure from the system of classification in the cahier des charges, they were generally conciliatory, calling the company's policy merely an "inconvenient excusable comme essai...."³⁰

Despite the restraint exercised by the central Administration, a confrontation was not long in coming. Believing itself persecuted by the Prefect, the company appealed over his head to Legrand, Sous-secrétaire d'Etat des Travaux Publics.³¹ In its letter, the company complained of continual threats and harassment by the Prefect, stating that in its opinion,

la compagnie n'est pas tenue de soumettre à l'approbation et même à l'homologation de l'autorité le tarif qui lui sert de point de départ, pourvu toutefois qu'elle se renferme dans les limites du cahier des charges....

Moreover, experimentation, it said, was necessary at the beginning when all was unknown, and the classification of goods laid out in the cahier des charges, which was the same for every railway company, would certainly need some changes. "Pour trouver la classification convenable pour notre ligne", the letter continued,

nous n'avons d'autres moyens que de nous mettre en rapport avec le commerce, que d'étudier ses besoins, ses rapports avec les anciennes voies de transport, que de chercher à connaître par la pratique les conditions auxquelles le nôtre pouvait s'établir.

Dans la classification il faut prendre en considération³² non seulement la nature (of the goods to be transported), mais leur provenance, les frais qu'elles ont déjà supportées, leur destination, les habitudes du commerce, de l'industrie et de la consommation, circonstances qui changent selon les localités.

Legrand replied with a sharp rebuke to the company, very clearly stating the Administration's position on every point raised by the company.³³

...Vous êtes tout-à-fait mépris sur l'étendue de vos droits et de vos obligations, et lorsque déjà, dans plusieurs autres occasions vous n'avez tenu aucun compte des avertissements,

des injonctions même de l'Autorité, vous ne devez pas être surpris que celle-ci, dans une question qui touche à tant d'intérêts, ait voulu faire respecter la loi.

Although the Administration, continued Legrand, had never claimed to stand in the way of companies charging rates within the maxima set out in their cahiers des charges, it maintained that formal administrative sanction by "l'autorité locale" was mandatory. As to the question of experimentation, the cahier des charges clearly stated that any new tariff must be maintained for at least three months, and that every change must be authorised by the Prefect. Furthermore, Legrand concluded,

Je dois...Messieurs, vous faire observer que (la) classification n'est pas abandonnée, comme vous semblez le croire, à votre libre disposition.

This was of the greatest importance, he said, in protecting the legitimate interests of the railway's competitors.

A compromise was soon reached, both parties adopting much more flexible positions than these initial statements seemed to indicate. The company replied that while it did not accept the Minister's claim that every tariff including the initial one was subject to homologation, or that homologation implied any form of approval, it would nevertheless once again submit a draft tariff to the Minister.³⁴ The company protested though³⁵ against the Prefect seeking advice from the Chambre of Commerce—holding an inquiry, it said—where its competitors in river and road transport were so well represented. Effective operation would be quite impossible if every Prefect along the railway's path were permitted to hold inquiries and to take upon himself the power to allow or disallow the company's tariff. The company was quickly assured by the Minister³⁶ that final approval of a single uniform tariff would come only from himself. The second and major concession by the Minister concerned the classification. The company continued even after Legrand's strong reprimand to maintain that it must modify the classification, and it did so in its tariff proposal of the 12th of September; it protested that³⁷

On se préoccupe beaucoup des industries rivales de leurs droits acquis, mais par le fait seul de l'établissement des chemins de fer n'a-t-on pas consacré l'anéantissement complet du roulage et une réduction du transport par eau?

The Administration, it went on, shows too much concern to protect these industries. The Administration quickly, though somewhat reluctantly, came round to the company's point of view. The Prefect of Police, who played an official role similar to though more important than that of the Prefects in each département along the railway line, refused to sanction the company's four-class tariff submitted in September; he conceded however, that to establish separately rated sub-classes would be permissible,³⁸ and with this bit of casuistry agreement on a new tariff was reached. Early in the new year the company submitted a new tariff on this model, and Legrand accepted the compromise. In his final report to the Minister however, he warned³⁹

Je ne me dissimule pas, M. le Ministre, combien pourraient avoir de gravité dans quelques circonstances, des déclassements du genre de ceux dont il s'agit ici. Il pourrait quelquefois en résulter des perturbations funestes dans diverses industries, et aussi ne doit-on les autoriser qu'avec réserve;...

But, he concluded,

dans l'espèce, les propositions de la compagnie me paraissent très convenables. Il est certain que, dans l'état actuel des prix du roulage, le maintien pour certains articles de la taxe du tarif équivaldrait à une prohibition, et il ne peut qu'être utile dès lors, dans l'intérêt du public d'autoriser l'abaissement des taxes que demande la compagnie.

He recommended full approval of the proposed tariff, and homologation came at the end of April.⁴⁰

While in future the Administration adopted a very permissive stance in its relations with the railway companies, this early experience demonstrated the inadequacy of the ad hoc system which depended for its legal base upon the sometimes vague cahiers des charges of individual companies. It also demonstrated the inability of local authorities to exercise regulatory powers of this kind by delegation. The growing number of railways coming into operation indicated that they should be taken more generally into account in administrative structures. The partisans of river transport would like to have seen not only administrative definition in the conduct of railway companies' business, but also a considerable measure of constraint on competition. A special committee established jointly in 1845 by the three Conseils-généraux of Agriculture, of Manufactures and of Commerce considered this problem and recommended very rigid limitations upon rate setting,⁴¹ which would have considerably reduced the competitive

pressure upon water-borne transport. Two ordonnances royales were rendered in 1846 and 1847. The first⁴² imposed only slightly tighter controls upon railway rate making, its most important provision being a flexible article forbidding the railways from charging any tariff not first approved and homologué by the Administration. To assist in enforcing this provision and to provide for more effective surveillance of inter-modal competition, the same ordinance also established commissaires royaux for each railway company, who were responsible to a single Commissariat central des Chemins de Fer. - At the beginning of 1846 the Minister of Public Works had established a new Service provisoire des Chemins de Fer comprising 202 engineers and conducteurs taken from other services,⁴³ and this was complemented by a permanent system of four advisory committees established by the second ordinance, in 1847.⁴⁴ Although tighter controls were in this way imposed upon the railways, it is doubtful whether either the rouliers or bateliers received much protection from them. Their object was not protection, or as it later became known, 'co-ordination' of transport, but simply regulation of fair competition. Control in future was more firmly placed at the centre, where it tended to be less sensitive to pressure from those injured by competition.⁴⁵

Competition with Road Transport. Between February 1844 and May 1848 the Paris-to-Rouen company altered its tariff five times, always generally in a downward direction. The first to feel the effects of competition was roulage, and the rouliers began to lose traffic to the railway almost as soon as it began its operations. During its first six months of operation up to December 1843, most of the goods carried were messageries, designated marchandises de grande vitesse, though there was also a small quantity of ordinary goods, designated marchandises de petite vitesse. The former were carried in wagons attached to passenger trains, the latter on goods trains. During these first months rates on the railway remained very close to the maxima allowed by the cahier des charges. Even at this level however, they were a considerable threat to the rouliers. Competition with the rouliers was for ordinary goods, and the railway company's highest rate for most of these was 27F.40 per ton, the lowest

18F.90.⁴⁶ There were only a few perishable, fragile and dangerous goods which were charged a higher rate of 41F per ton. In 1843 roulage ordinaire from Rouen to Paris cost about 35 F per ton, while faster roulage accéléré cost 70 F or more.⁴⁷ Although roulage accéléré came close to the railway in speed — about thirty hours compared with the railway's normal twenty-five — its tariff was comparatively high; on the other hand, though the rate charged by roulage ordinaire was lower than the highest rate on the railway, its slow speed — three to four days from Rouen to Paris — made it a less effective competitor in this respect. The railway could also offer much greater security from damage, for which road transport was notorious. This is not to say however, that the rouliers were immediately forced to the wall as their colleagues carrying passengers had been. During the first six months of its operations the railway company's total revenue from the carriage of goods was about 550,000 F.⁴⁸ In the absence of any record of the quantity or type of goods carried, they may be estimated to have been about 20,000 tons, including both grande and petite vitesse in both directions.⁴⁹ This was certainly less than the traffic carried by roulage, and in any case much of it was taken from the compagnies de messageries. During all of 1843 roulage is said to have carried a total of about 170,000 tons between Rouen and Paris. In 1844 this amount fell by almost forty per cent to little more than 100,000 tons,⁵⁰ but it was only over the next two or three years that the rouliers were compelled to give up much, though not all, of their accustomed inter-city goods traffic.

It is evident that the commissionnaires de roulage, the operators of roulage, had hoped at first to continue a large part of their inter-city goods services. They had little experience of price competition, and they seem not to have expected much from the railway. If, as they hoped, the railway were to maintain a tariff close to its legal maxima, the effect of price competition with it could be minimized. Moreover, the commissionnaires stated,⁵¹ they had planned to become extensive users as well as competitors of the railway; this could be done if they were permitted to group their consignments for transport on the railway at single bulk rates. In addition the commissionnaires hoped still to operate over their established and extensive routes,

using the railways to carry their wagons over certain trunk routes where they existed. Arrangements of just this kind were made between the railway and the compagnies de messageries in August, which allowed the latter not only to group their parcels and to consign them to the railway at a single rate, but also to have their carriages and drivers themselves carried by the railway. In anticipation of the railway's coming, the commissionnaires stated, they had made new arrangements with clientèle and new traités de relais to take account of the new conditions they thought would prevail.

The railway company however, seems to have been determined that it should itself be the sole carrier of general merchandise on its line. Its management was confident that the advantages offered by railway transport—in its words— "sous le rapport de la rapidité, de la sûreté et de l'économie sont tellement sensible, que les habitudes prises, les préjugés, les intérêts rivaux eux-mêmes ne peuvent résister longtemps à cette supériorité."⁵² The company set up a bureau de réception on the Rue St.-Nicholas in the centre of Rouen, and announced in a public circular on the 14th of July 1843 that until its regular service for marchandises de petite vitesse began, it would carry all goods on its passenger trains, but at the regular rates. To overcome the "habitudes prises" of its rivals' clients, the railway's agents actively solicited business in Rouen, sometimes, said the rouliers, offering to carry goods at less than the published rate. One of the chief advantages not only of road but also of water transport was direct door-to-door service, and to overcome it the railway offered pick-up and delivery à domicile for a small extra charge of only OF.30 per ton. Except for its chosen agents, this removed even the railway's delivery service from the grasp of the rouliers.

The commissionnaires de roulage in Rouen very quickly understood that they were faced with a formidable new competitor, and they became increasingly alarmed by this threat. Their first reaction shortly after the railway began carrying goods, was to appeal to the local authorities for protection. Led by the Compagnie Veuve Malcouronne et fils, the largest of the rouliers in Rouen, five local companies with transport services to the west, south and east of France joined in a petition to the Prefect

of the Seine-Inférieure asking him to enforce compliance by the company with the obligations stated in its cahier des charges.⁵³ They protested not only against the company's 'illegal' alteration of its tariff—until homologation, they believed, the company could legitimately charge nothing less than the legal maxima—but also against its attempt simply to act as a private common carrier. This, they maintained, it was not. It was a publicly sanctioned monopoly, upon whom strict statutory controls had been placed. They insisted especially that the company must be compelled to stop experimenting with its tariff and to observe the requirement that it give three months notice of any changes. Favouritism toward particular rouliers, they continued, must cease. The company, they complained in a second petition about a month later, was behaving "absolument comme le ferait une entreprise particulière livrée à sa propre volonté."⁵⁴ Any further disregard of the law by the railway, they said, would be fatal to their existence. They protested also to the Conseil-général of the Seine-Inférieure.⁵⁵ The Prefect was inclined to protect the commissionnaires de roulage, even if this should require the use of force against the railway. In this however, as we have seen, he was overruled. The rouliers tried to compete by cutting their own rates,⁵⁶ but when the railway drastically reduced its rates in February 1844, by as much as one-third for some commodities—the new rates were only 20F and 15F per ton—they were no longer able to follow. By this time the rouliers were not alone in their growing sense of alarm. They had been joined in the chorus of protest by the maître marinières de la Seine, and both had the full support of the Chambres of Commerce in Rouen and LeHavre. It was the common belief of all that the railway was bent on destroying every source of competition. In the Prefect's view, the situation was becoming explosive, and he warned the Minister of impending violence in Rouen if the company were not either brought to heel, or its proposed tariff officially sanctioned.⁵⁷ The latter in fact was very soon done.

With little prospect of help from the administrative authorities the commissionnaires de roulage turned to other more direct means, one of which yielded a measure of success. First they refused to transport any goods destined for or which had been handled in any way by the railway; they refused even to

transport goods for any person who had any dealings with the railway.⁵⁸ When the company countered these tactics by organizing its own services de correspondance, the rouliers brought action against the company in the Cour royale at Rouen, but were unsuccessful.⁵⁹ In another action however, they were more fortunate. Before the Tribunal de commerce at Rouen,⁶⁰ Colombet et Abrice, commissionnaires de roulage, alleged that when they had attempted to combine groups of small parcels for transport on the railway at a single rate, the company's employees had dismantled their consignments and charged the full rate to each of the small parcels they contained; this was not done, they said, with parcels sent by the compagnies de messageries. The court found in favour of the plaintiffs, and ordered the railway company to pay them 1,000 F damages and to refrain from dismantling their consignments in future. This was an important victory, for it allowed the rouliers to use the railway as they had hoped, as a link in their established routes. Attempts were also made to negotiate an agreement with the railway, but these failed owing to the exorbitant demands of the commissionnaires de roulage. They demanded that in return for a promise to send all their traffic by the railway where this was possible, the railway should charge them a rate forty per cent less than that charged to goods coming to it directly, and that the latter should pay the full maxima. For the railway, its management stated, this would have meant "l'abandon d'une portion si considérable de nos recettes qu'il nous a été impossible d'admettre les propositions de traités qui nous été faites."⁶¹ Another year passed and once more the rouliers took the company to court. Before the Tribunal de commerce de la Seine, six of them demanded damages totalling almost 540,000 F.⁶² They accused the railway of openly soliciting traffic from the former clientèle, of carrying on its own services de correspondance, and of giving privileged access to its stations to certain commissionnaires de roulage. Once again however, they lost. The company denied none of their allegations, all of its actions, it maintained, being entirely within the law. As for the fate of the rouliers, its counsel commented with a fine sense of progress, "tout marche, le passé laisse ses ruines, et l'avenir amène ses merveilles."

Inter-city road transport along the Seine was certainly reduced to a tiny fraction of its former size by competition from the railway, but it was not entirely eliminated, even by the mid-1850s. The rouliers could exploit two principal advantages over the railway, flexibility in scheduling and door-to-door service, both particularly important to some shippers. The most important commodity to which this advantage applied was cotton cloth, sold every week in Rouen on Thursdays and Fridays, assembled into wagon loads on Saturday and Sunday, and delivered by roulage to wholesalers in the Place des Victoires in Paris early on Monday mornings.⁶³ The railway would accept consignments in Rouen only up to noon on Sunday, and guarantee to deliver them — and that only to its terminal at Batignolles — only by Tuesday morning. On weekdays goods were accepted up to eight in the evening for delivery to Batignolles by ten o'clock the following morning. The few hours between close of business and eight o'clock in the evening on Friday were too short for the merchants to prepare and deliver them to the railway. By using roulage accéléré they could still be assured of arrival before Monday morning even if they were not sent till late on Saturday. Because premium prices were obtained by goods delivered early, the rouliers, despite their higher rates continued for several years to carry this traffic. It was estimated in 1849 that of the fifteen tons of rouenneries sent on average each day from Rouen to Paris, nine went by road. In 1849 the railway company attempted to put an end to this competition by offering terms to four of the ten or so commissionnaires de roulage in Rouen promising them good delivery times and concessionary rates. In an agreement which took effect in July 1849 the railway promised to carry goods consigned to it by the commissionnaires de roulage at special low rates and to permit them to consign goods at times convenient to the needs of their special trade. In return the rouliers were obliged to "démonter...les services de roulage accéléré existant aujourd'hui entre Paris, Rouen et LeHavre...", nor could they consign goods for transport to any of the remaining commissionnaires de roulage; it was hoped indeed that these would be forced off the road, and the company reserved the right to revoke the agreement

sans indemnité dans le cas où deux services de roulage accéléré entre Paris et Rouen ou entre Paris et LeHavre existant actuellement ou créés postérieurement à la signature des présentes se maintiendraient sur la route pendant un délai de six mois.

Within a month however, the intended victims protested to the central authorities. In the ensuing investigation of the agreement, which appeared at first to have been illegal, it became apparent that they too could have obtained the same concessions. By staying out they lost a great amount of traffic to the others.

Despite this agreement the commissionnaires de roulage survived to prosper during the 1850s. An examination of the Almanach du Havre for the years 1840 to 1860 shows that of the eight or so commissionnaires de roulage active there in 1845, four remained in business during the 1850s, and four disappeared; at the same time, at least fifteen new ones came on the scene. Several continued to advertise "roulage accéléré et ordinaire, départs tous les jours pour tous les pays", while several also advertised themselves as "Entreprise(s) général(s) des transports par chemins de fer, grande et petite vitesse pour toute la France et étranger, délais garantis". Even on the route between Paris and LeHavre roulage continued for a while to survive. According to Adolphe Thibaudé, the railway's general manager, by March 1850 two charettes accélérées left Rouen each day in both directions, and carried about 12,000 tons of goods per year.⁶⁴ On many of their other routes of course the rouliers faced no competition yet from the railway, and retained much of the accustomed business. Of far greater importance to the continued survival of the commissionnaires de roulage was the change in the nature of their businesses which many of them were able to bring about. They became more general commissionnaires de transports, continuing a trend the origins of which can be traced back to the beginnings of roulage accéléré, acting not only as transporters of goods on their own account, but also accepting consignments of goods for the other modes of transport, both water and rail.

Competition with Water Transport. For the first couple of years the bateliers de la Seine were able fairly effectively to prevent the railway from taking large amount of their accustomed traffic, though at some cost to their revenues. After a second tariff reduction by the railway late in 1845 greater amounts of traffic were taken, but it seems to have been only after the railway's extension to LeHavre that it was able to take a large proportion of the river's traffic. Table 9 summarizes this history up to 1850.⁶⁵

Table 9

Goods Traffic by River and Rail between Rouen and Paris,
1840-1850 (tons).

	<u>traffic by river</u>		<u>traffic by rail</u>	
	<u>upstream</u>	<u>downstream</u>	<u>to Paris</u>	<u>to Rouen</u>
1840	234,103	158,864	-	-
1841	268,694	180,255	-	-
1842	258,850	168,383	-	-
1843	343,523	241,525	...	...
1844	251,144	162,196	78,100	26,042
1845	281,421	164,943	103,190	42,948
1846	245,958	150,885	195,815	51,661
1847	248,131	144,176	268,302	58,701
1848	133,054	86,779	141,083	59,024
1849	166,179	154,079	178,369	97,808
1850	197,502	149,857	180,387	107,952

The traffic taken by the railway from the river in 1843 seems to have amounted to no more than about 30,000 tons, though more was taken from the rouliers. Goods traffic on the railway increased sharply at the beginning of 1844, partly at the expense of the river, but until the end of 1845 it continued to be fairly small compared with later years, and much smaller than that carried by the river. The impact of competition upon river transport was exaggerated in 1844 by a general decline in trade, and the loss of traffic by the river to the new railway was not so great as it first appeared to be. The total decrease in upstream river traffic from 1843 to 1844 amounted to almost 100,000 tons or nearly thirty per cent. The bateliers had enjoyed very heavy traffic in 1843, with particularly large cargoes of wines from Bordeaux and of construction timber (which together comprised forty per cent of the total), and most of the decline in 1844 was owing simply to return by these commodities to more normal levels. In its first couple of years the railway made little or no impact upon the staples of river transport, construction timber, building stone and wine, or on several others. Significant amounts of about ten commodities did shift to the railway in this initial period, but only one of them was of any great importance to the bateliers. All of them were costly goods for which speedy transport was valuable. The most important of them was spirits, and the others were copper and tin, the two most valuable metals, raw cotton, hides and skins, coffee, olive oil, raw tallow and

soap. In 1843 all of these had amounted only to fourteen per cent of total river traffic, in 1842 nineteen per cent.

In its initial years, when the railway went only as far as Rouen, it was unable to show its full competitive strength. Moreover, as in the case of the rouliers, the bateliers, found a source of defensive strength in the traditional patterns of transport. Many storage and handling facilities and many industrial plants, where such goods as wine, timber, stone, grain and sugar were delivered, were located beside the waterways. Shippers of these goods by railway were forced to pay high terminal and cartage charges, and in the first couple of years with these added even to specially (and illegally) reduced railway rates, most shippers apparently still found it more economical, where time was not important, to ship by river. An example could be cited, the case of Lombard aîné et fils, marchands de bois in Paris.⁶⁶

Nous vendons tant à Paris que dans la Banlieue (wrote Lombard) une très-grande quantité de bois de sapin provenant du nord de l'Europe. Ces bois nous parviennent par les ports de (sic) Havre, Honfleur, Calais et Dunkerque. Notre intérêt nous commande de chercher les voies de transport les plus économiques. Depuis Rouen à la Villette, par les bateaux normands le transport de nos bois coûte 12F.50 du tonneau. Le tarif du chemin de fer pour la dernière classe est de 15F.; mais le Directeur, dans le but de s'attirer nos affaires, consentit au prix de 12F. Nous avons fait l'essai sur 150 tonneaux de madriers en dimensions d'un maniement facile, et nous avons reconnu que nous ne pouvions donner suite à cette voie d'expédition. Les frais de port à l'embarcadère de Rouen, ceux du débarcadère des Batignolles à notre chantier de la Villette nous ont coûté 3F. par tonneau. En outre pour des quantités importantes il résulte grand désordre.

The impact of competition however, should not be understated. The bateliers were able to minimize losses from their accustomed traffic only by lowering their rates to stay below those of the railway, and this could be done only at a considerable cost. The bateliers suffered a large decline in revenues in 1844 and 1845, almost half of it attributable to competition from the railway. In 1842 rates for river transport had been set by agreement at an unprecedented high level, and although somewhat lowered in 1843, they had remained very high.⁶⁷ In February 1844 the railway reduced its rates to 15F and 20F per ton from Rouen to Paris,⁶⁸ most of those

commodities carried by river being rated at 15F. To retain their traffic the bateliers were forced to follow. Beginning in 1844 their rates were pulled down to levels which had been unknown since the severely depressed year of 1831. The average rates fell from 14F.55 in 1843 to 12F.93 in 1844; the maxima fell from 19F.00 to 13F.80. At such low rates, according to one contemporary authority,⁶⁹ many of the bateliers were barely able to meet their immediate direct costs of operation. Early in August 1844 the railway company announced further reductions;⁷⁰ new special rates were offered for direct shipments from Rouen to Paris, and applied first to seven commodities commonly carried by the river: iron, zinc, lead, oils, beer, and asphalt.

There was genuine fear that with their rates being forced even lower, the bateliers would be unable to continue their struggle. The Prefect in Rouen was very alarmed and wrote to the Minister of Public Works⁷¹ that if the railway were permitted to continue in its present course, "la batellerie de Rouen et de tout le littoral sera certainement anéanti", adding "(j'insiste sur ce point)". The protests of the Chambres of Commerce, he warned, could not much longer be ignored. Letters of protest were received not only from the Chambre of Commerce in Rouen, but also from those in LeHavre and Paris,⁷² complaining that the railway's rate reductions were unfairly aimed at commodities habitually carried by the river, with the object, they said, of forcing the bateliers out of business. The railway's classification of goods, its lower rates for direct shipments and reported rebates to large shippers were all described as illegal. Moreover, they claimed, the railway company had recently made a secret agreement with a group of Northumberland mine owners for transport of large quantities of coal at special low rates, in violation of Section 35 of its cahier des charges.⁷³ The special commission referred to above, formed by the Conseils-généraux of Agriculture, Manufactures and Commerce, commented that⁷⁴

Par la position toute spéciale où elle s'est trouvée placée par les éléments de concurrence naturelle qu'elle devrait rencontrer dans son exploitation, cette compagnie a porté en naissant son péché original, nous voulons dire, sa tendance à transgresser la loi et son cahier des charges.

This was not the view taken by the Administration, and although certain changes in the form of the tariff were requested by Legrand and agreed to by the company, it was quickly authorized.

When once again the Prefect delayed homologation, he was firmly chastised.⁷⁵ An inquiry was opened into the alleged illegal agreement for transport of coal, but very little seems to have come of it. It was common knowledge that similar agreements on a somewhat smaller scale were made by the bateliers.⁷⁶

Having apparently received no protection from the Administration, the bateliers, like the rouliers, were compelled to devise other means of defence. Following a half-hearted attempt late in 1845 to negotiate an agreement with the railway to end competition,⁷⁷ a group of about five of the largest operators of tugboats (Bertin, Expert, Hurault de Ligny, Lecoq and Pauwels) agreed early in 1846 to an informal alliance to compete against the railway, calling themselves the Compagnie de l'Union.⁷⁸ Between them they owned almost a dozen steamers, most of them tugboats. It was a very loose arrangement, as there were other alliances formed outside it by some of its members, but it does seem to have included at least some kind of common pricing policy and revenue pooling arrangement. One of the group's first actions was to sue the railway company for 600,000 F damages done to them by illegal application of its tariff. They won a limited victory by this means, being awarded 90,000 F plus costs later in 1845.⁷⁹

During the next four or five years the bateliers' strength was steadily eroded as their traffic and revenues continuously declined. There were several reasons for this, including low water levels during 1846, further rail tariff reductions, the beginning of direct railway service from Paris to LeHavre, and the very serious economic and political crisis in 1848. Unlike road transport however, water transport continued during these years and through the 1850s to carry a large proportion of the total traffic. Low water levels on the Seine forced the bateliers to raise their rates slightly during 1846; this may also have made direct transport from LeHavre to Paris more difficult. In the following year, with the line opened to LeHavre early in March 1847, the railway was able for the first time to offer direct service from LeHavre to Paris. "Sic Lutetia portus" (roughly "Thus is Paris a seaport") was the device carried on the wagons of the Rouen-to-LeHavre railway.⁸⁰ The new railway carried about 160,000 tons eastward from LeHavre in its first year, much of it grain, of which large shipments were brought to LeHavre from foreign ports during 1847. About half of these goods seem to have

continued to Paris,⁸¹ and with their help traffic on the Paris-to-Rouen increased by almost 40 per cent to about 14,000 tons per month. River transport direct from LeHavre to Paris fell at the same time by about one-quarter. The older allèges and bateaux normands operating on either side of Rouen managed to hold their own, though only owing to a large share in the transport of grain. About 46,000 tons of grain were carried by allèges to Rouen and trans-shipped there to bateaux normands for Paris. Without this the amount of goods carried by allèges would probably have fallen by about thirty per cent, and that by bateaux normands by about twenty. Some of this potential fall in traffic must be attributed to the railway; some was also owing to reduced shipments of such staples of transport as wines. River transport direct from LeHavre to Paris was faced with real competition for the first time, and as a result water-borne traffic of this kind fell by about one-quarter. A beneficial effect of this competition however, was to bring about greater use of tugboats on the Basse Seine. Of the boats coming directly from LeHavre and destined for Paris, the proportion pulled by tugboats rose from 32 per cent in 1846 to 38 per cent in 1847. Of the boats coming only from Rouen, the proportion using tugs rose from only 30 per cent to 45 per cent.⁸² Some credit for this may go to the newly formed Cie de l'Union.

1848 was a distasteful year for every kind of transport in the Seine valley. The economic crisis had a much more serious effect upon the batellerie than competition from the railway. For a few weeks after the journées of February almost all commercial activity came to a halt, though it revived somewhat through the remainder of the year. In the words of the Chambre of Commerce of Rouen,⁸³ the crisis

a fait cesser presque toute expédition d'outre-mer et de cabotage.... Le mouvement maritime est arrêté, un grand nombre de navires sont désarmés au port, les travailleurs naguère si occupés sont aux ateliers communaux où ils se démoralisent et ne produisent rien.

Over the whole of 1848, coasting trade to Rouen fell by almost sixty per cent from 1847, foreign trade by 54 per cent; coasting and foreign trade to LeHavre both fell by forty per cent. Traffic on the river from Rouen to Paris fell by 46 per cent, on the railway by 47 per cent. Shipments of wines, timber, building stone and grain were greatly reduced, and in several cases fell even farther in 1849.

While this economic crisis certainly caused considerable suffering amongst the seven or eight hundred men, maîtres mariniers, compagnons and garçons de bateaux, who operated the marine normande, it also brought about some useful 'structural' changes. Aided by arrangements like the Cie de l'Union and other overlapping informal agreements, the owners of tugboats were unique in maintaining the position they had attained in 1847 almost intact. Their traffic fell by little more than one per cent, and continued to rise again in 1849. They were able to do this however, only at considerable sacrifice, for with further rate reductions by the railway, they were forced to lower their own rates to twenty per cent below those of 1847.⁸⁴ Already they had been quite insufficient to cover costs. In 1849 the volume of traffic still remained far below normal, and there were further substantial reductions in rates. Coffee, one of the principal commodities which had for many years been carried by chalands from LeHavre to Paris, had by this time gone entirely over to the railway.

Further structural changes affected the tugboat operators themselves. In a vastly reduced market, and under such intense and continuous competitive pressure, it was almost inevitable and indeed desirable that there be a reduction in the number of tugboat companies. Between 1848 and 1850 four companies went out of business and several others were forced considerably to reduce their operations. Owing to substantial losses, the Cie de l'Union was forced to disband in 1850.⁸⁵ Already in 1848, the first of its members, Lecoq had dropped out, selling his two remaining tugs, the AIGLES, to a newly formed rival group, the Association marinière de Labrousse, Poulain, Potet et Cie. In the same year Bertin et Cie of LeHavre announced they would merge all their services with LeNormand-Baudu of Rouen,⁸⁶ but in the following year, on the expiration of its charter, the Cie Bertin also decided to disband.⁸⁷ Its three old tugboats, by then over twenty years old, and twelve of its chalands, were sold at auction in the middle of 1849. The remainder of its chalands seem to have been left idle in the Bassin Vauban at LeHavre for several years. The Cie Expert, another member of the Union, though not forced entirely out of business, seems to have been

compelled to sell some of his equipment, and to discontinue operations between Rouen and Paris. The Cie Hurault de Ligny, operators of one tug on the Seine-Maritime, were forced out of business. One of its competitors, the Cie Rouennaise, which had been formed in 1837, was also forced to disband when it came to the end of its charter in 1850.⁸⁸ The number of steamers engaged in goods transport (including the tugboats) fell, according to Expert,⁸⁹ from 23 before 1848 to only 13 by 1850. The number of chalands in operation on the Seine, according to statistics published by the Chambre of Commerce in Rouen, fell from 53 in 1847 to only 36 in 1850.⁹⁰ The number of companies operating on the Basse Seine was reduced from six or more to only three, LeNormand-Baudu, the Cie des Aigles (de Labrousse et Cie) and the Société générale des remorqueurs parisiennes (also called the Cie Blanchon, and including elements of several old companies, among them Pauwels and Lacour de Riberprey).

The effects of the crisis were quite different upon the traditional marine normande. Those who were unable to make use of tugboats — certainly the great majority at this time, from lack of working capital to pay the charges — suffered the loss of more than three-quarters of their traffic, and the number of voyages fell from more than 500 in 1847 to little more than 100 in 1848. They also suffered from the same competitive pressure upon rates as did the tugboat companies. The prevailing mood among the mariniers seems understandably to have been one of almost unrelieved despair. By late 1848, in the words of an experienced observer of the Basse Seine,⁹¹

en face de cette concurrence terrible, les mariniers ont perdu toute confiance en eux-mêmes, et voyant leur ruine presque imminente, ils n'ont plus pensé qu'à mettre à profit leurs derniers jours d'existence....

Although after 1848 halage, like many independant crafts in industry, was certainly doomed to extinction, many of the bateliers did survive into the 1850s, turning increasingly to remorquage. Concentration of ownership increased only very gradually through the 1850s.⁹² The effect of reduced revenues upon these individual bateliers was quite different than upon the tugboat companies. The latter were composed of shareholders or partners interested in an economic return on their investment; moreover, they had relatively costly and complex equipment to

maintain and replace. The level of long-run fixed costs (in the form of depreciation, interest and maintenance) was therefore quite high. Equally the length of time their payment could be postponed was also limited. In contrast to this, each maître marinier was the owner of his boat (and perhaps one or two others) and lived on board. It was possible for him to survive a long crisis on simple economic inertia. With relatively crude equipment and methods, he could reduce maintenance to a minimum, postpone indefinitely the accumulation of reserves for replacement, reduce his own standard of living and the salaries of his employees. Even by 1854 the monthly income of compagnons marinières remained as low as only 40 F, compared with more than 100 F in the mid-1840s.⁹³ By ceasing operations, his income would fall to nothing and his boat deteriorate, making any later resumption of operations very difficult.

Success and Failure for the Railway Companies.

The railway companies were successful in this initial period in taking from road and water transport a substantial portion of their accustomed traffic. The companies' ultimate objective however, was not merely to carry the largest possible quantity of goods and passengers, but to maximize their profits. Though the Paris-to-Rouen achieved a considerable measure of success in this, the Rouen-to-LeHavre did not. This can be seen in Figure 15.⁹⁴ In the seven years between the commencement of its operations and the end of 1849, the return on total investment to the Paris-to-Rouen company was never less than about 3.5 per cent, even in the disastrous first half of 1848; it rose as high as 9.4 per cent, and over the whole period, excluding the first six months of 1848, averaged 7.1 per cent. For the Rouen-to-LeHavre, on the other hand, in the three years following its beginning of operation in March 1847, the return on total investment never rose above 3.2 per cent, and fell to less than one per cent in the first half of 1848; over the whole three years, with the exception of these six months, it returned an average of only 3.7 per cent. Since these percentages take into account total investment, including long-term debt and grants from the state, the return to shareholders was greater. After subtracting amortization and the amount due to the company's 'founders', dividends from the Paris-to-Rouen came to as much as 10.3 per cent of the par value of shareholders' equity; over the whole

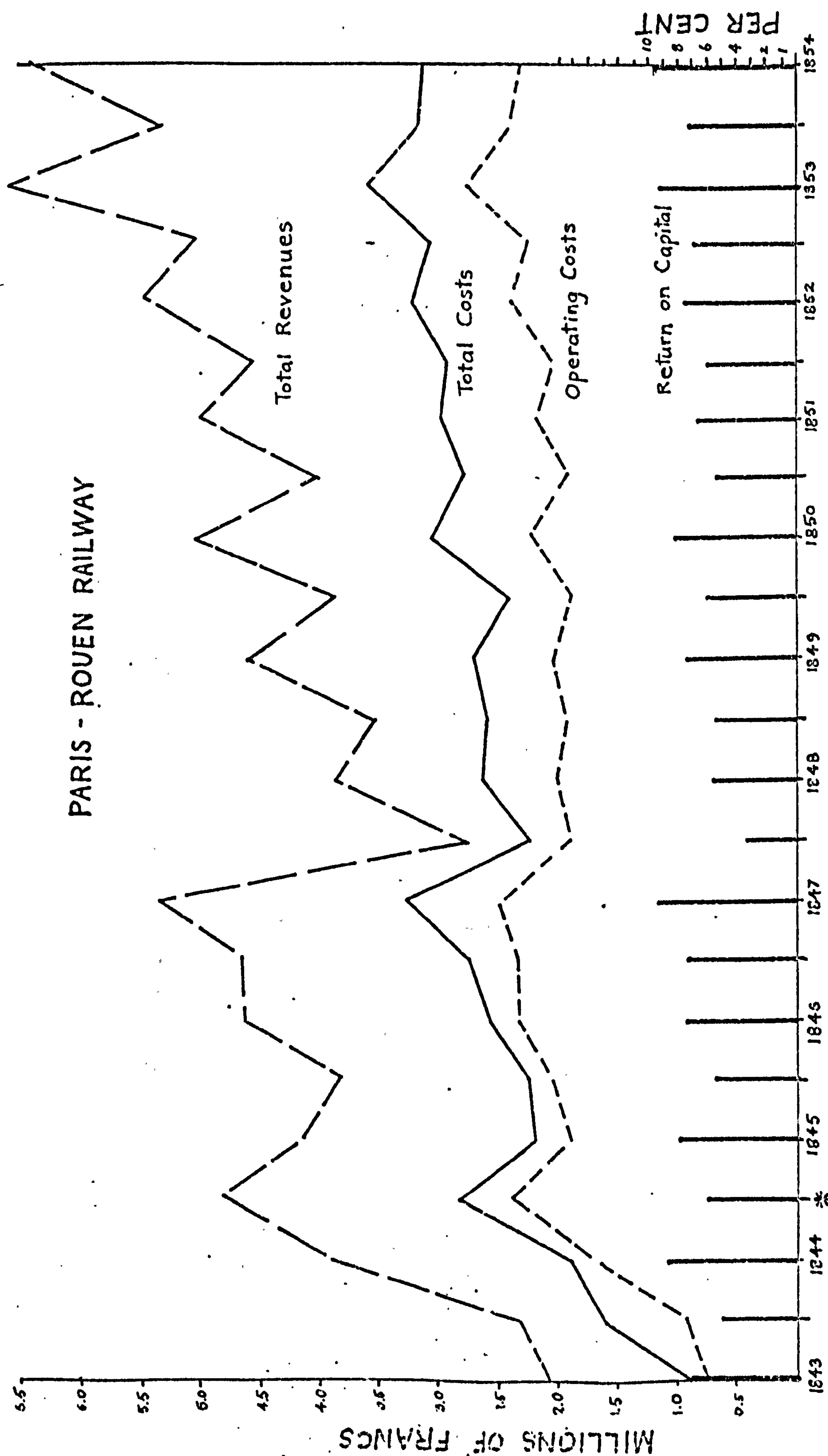


FIGURE 15 (a)

RAILWAY FINANCIAL PERFORMANCE, 1844-1854

ROUEN - LEHAVRE RAILWAY

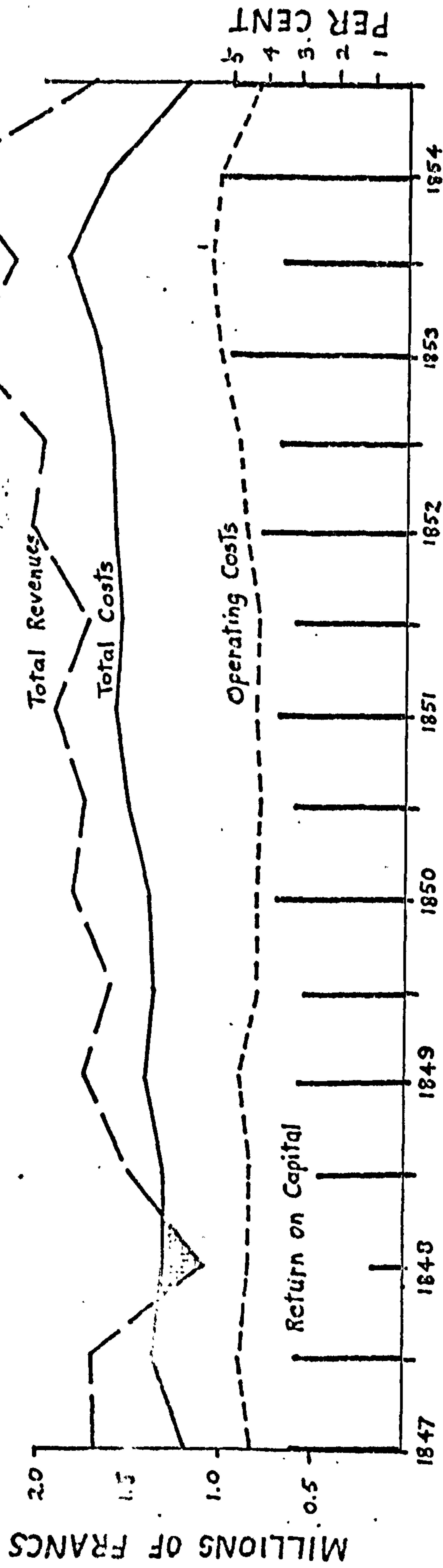


FIGURE 15 (b)
RAILWAY FINANCIAL PERFORMANCE, 1847-1854

period it averaged 7.5 per cent. Owing to very much higher costs to bondholders, the return to shareholders in the Rouen-to-LeHavre company in the first three years of operation was never more than 4.5 per cent, and owing to a substantial net loss in the first half of 1848 averaged only 2.4 per cent in that year.

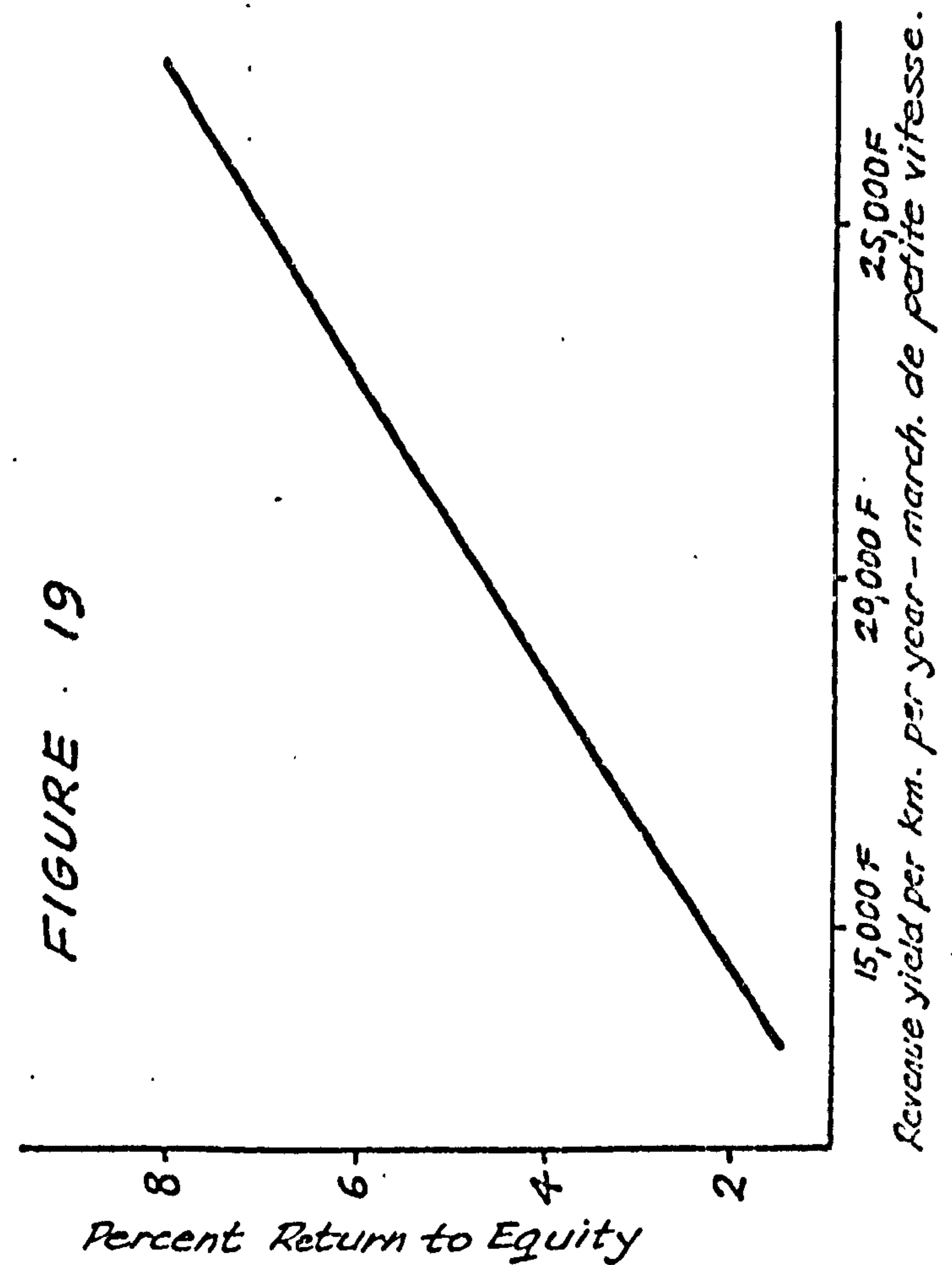
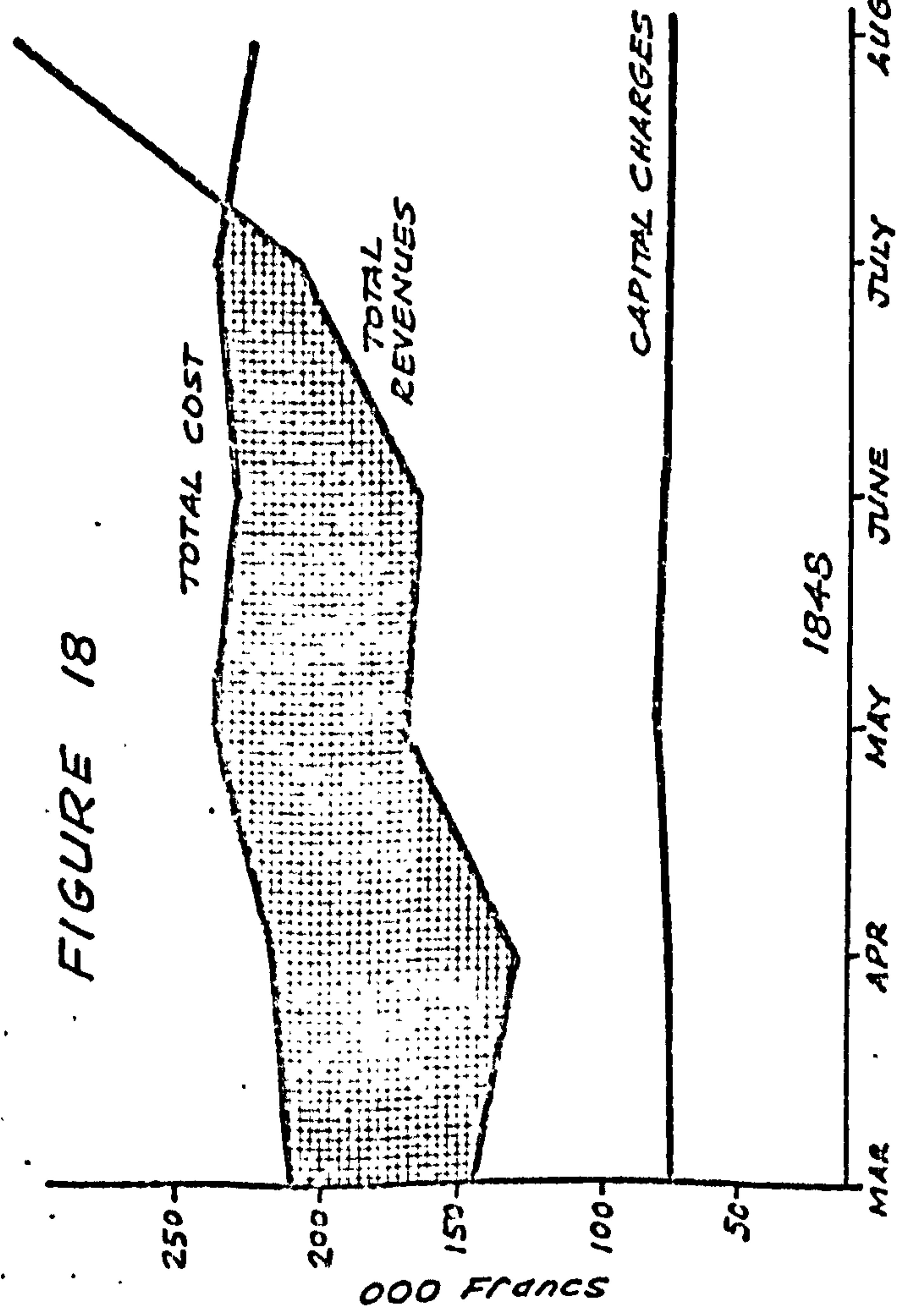
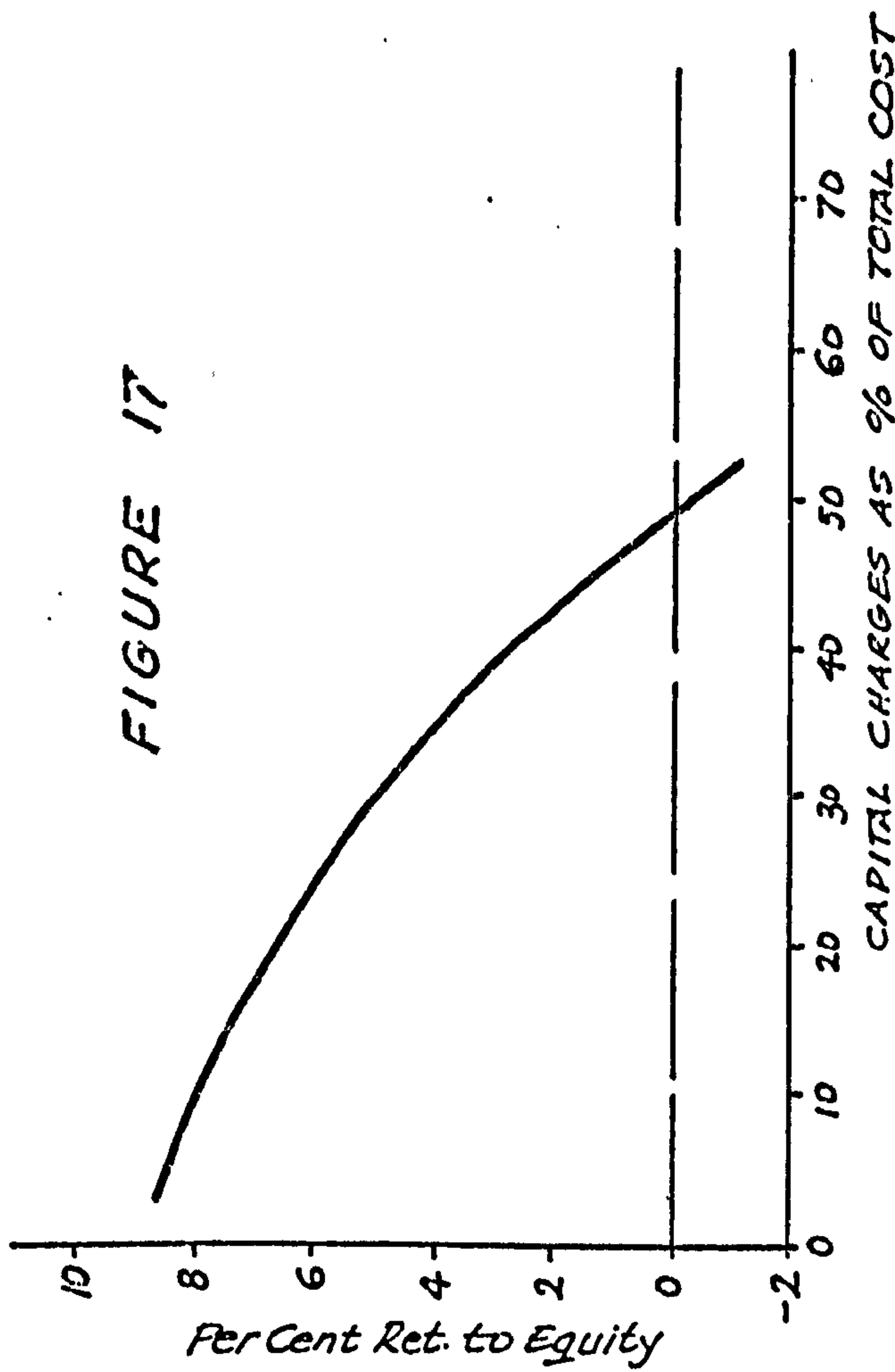
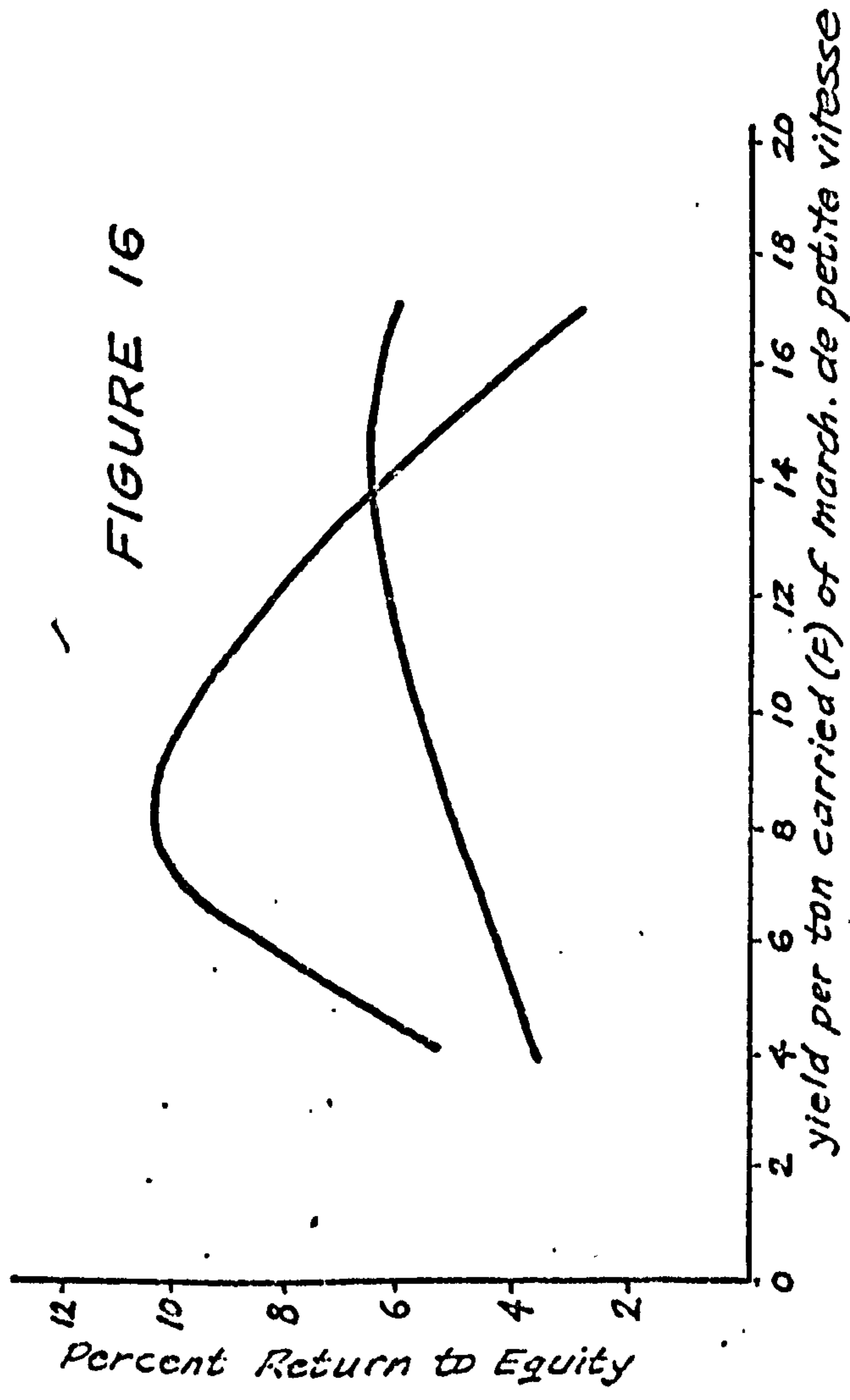
One of the most important factors in the competitive success of the Paris-to-Rouen railway was its very large passenger revenues. The contribution by passenger receipts to the company's net revenues was very considerable, much greater than that by goods. Without substantial revenues from both of these sources — something none of its competitors had — the railway's profits would have been greatly reduced. If it had been forced to rely upon goods revenues alone, it would have been hard pressed to earn any profit at all. It would have suffered from the same economic problem encountered by the early steamboats, underutilization of capital. Its right-of-way, track, stations and rolling stock — the high cost of which would not have been greatly reduced had the railway been built to carry only goods — would have earned insufficient revenues to make them a paying proposition. A monopoly of passengers was also important; had the passenger traffic in the first half of 1846, for example, been one-quarter less than it was, the return on shareholders' equity would have fallen from almost eight per cent to only 5.5 per cent. With monopoly control of passengers, the company was able to charge them fares which contributed more than a fair share to its fixed costs of operation and capital. Though goods traffic certainly more than met its direct variable costs, it is likely that it paid less than its share of fixed costs.⁹⁵ The ability to assign costs in this manner gave the railway a strong advantage in competition for goods traffic.

The mariniers seem to have been unable, or unwilling, to reduce their rates below about eleven francs (on average), and this was also of considerable importance to the company's financial success. To understand this it is necessary to examine in somewhat greater detail the competition between railway and mariniers. There were few general principles upon which Adolphe Thibaudau, directeur of the Paris-to-Rouen, could base his tariff-setting policy. One however, put into modern terms, was a commonly held belief that the price elasticity of demand for rail-

way transport was very high. An article in the Journal des Chemins de Fer,⁹⁶ for example, shortly after the commencement of service on the Paris-to-Rouen advised its management that a low tariff would be to their advantage. It pointed to examples in Great Britain and in France to show that passenger and goods revenues tended to increase as fares were reduced; moreover, it attempted to show that because average cost fell as traffic increased, net revenues and therefore profits would rise as fares and rates were reduced. The company's shareholders agreed and at an early stage they urged that the tariff be reduced.⁹⁷ The company's management seems to have taken this advice, for as we have seen, the tariff was substantially reduced a number of times. After the first of these reductions, in February 1844, goods traffic on the railway substantially increased, sufficiently so that although the revenue yielded by each ton fell from about 21F.80 to about 15F.30, total revenues from goods increased almost two and a half times. Though part of this increase can be attributed to the new availability of facilities for handling goods, it seemed nevertheless to be a good demonstration of high elasticity. The effect however, did not last.

A well known phenomenon in oligopoly — competition among a small number of rivals—is retaliation; rivals who are threatened by price reductions will follow if they can with their own.⁹⁸ This the mariniers did, though slowly; although their average rate fell only from 14F.55 in 1843 to 12F.93 in 1844, they were able further to reduce it to only 11F.70 in 1845. This reduction, along with a general increase in prosperity permitted them to retrieve part of the traffic and the income they had lost in the previous year. The railway's management was clearly disappointed by this turn of events, as they later reported to the shareholders.⁹⁹ By retaliation the mariniers had limited growth of the railway's traffic to little more than a third of their own; by lowering their rates to be competitive with those on the railway, they had in effect reduced the high elasticity of demand upon which the railway depended to take a large share of their traffic.

When the railway reduced its tariff a second time, in November 1845, the mariniers were no longer able to follow. While the yield from each ton of goods carried by the railway fell



from 14F.70 to 11F.75, the average rate charged by the mariniers rose from 11F.70 to 12F.15. As a result, in 1846 goods traffic on the railway once again rose steeply, reaching eighty per cent of traffic on the river, and in 1847 for the first time exceeding it. River traffic from Rouen to Paris fell to its lowest level since 1840. Had the mariniers been able once more to follow the railway's price reductions, the result might have been quite different. An attempt has been made to show this with the graph in Figure 16. In this graph the upper line shows the effect of reducing the railway company's goods tariff upon its return to equity, using the value of elasticity which actually prevailed during the first half of 1846. The lower line attempts to show the effect of the much lower elasticity which would have resulted if the mariniers had been able to lower their tariff. These show that if the lower rather than the higher elasticity had existed the company's return to equity would probably have remained at about six per cent instead of rising to eight per cent.¹⁰⁰

Why did such success elude the Rouen-to-LeHavre company? There seem to have been two main reasons. The more important reason had its roots in the railway's very high costs of construction. As a result of these very high costs, the company had to bear very large fixed charges upon its revenues. These fixed charges, the cost of amortization and of interest upon the company's bonded debt, amounted to almost 550,000F by the beginning of 1849, 37 per cent of its total costs. This compared with the Paris-to-Rouen company's fixed charges which were only 23 per cent of its total costs. The graph in Figure 17 attempts to show what the effect of these high fixed charges were upon the Rouen-to-LeHavre company's return to equity. If these charges could have been reduced to the same proportion as on the Paris-to-Rouen the company's profits could have been increased to over six per cent.

The effects of these large fixed charges were not easily diminished. A slight improvement in the dividends paid to shareholders was made possible by a change in the system of amortization at the end of 1847. According to the company's charter, the entire equity capital had to be paid off in about fifty years from the beginning of operations. To do this 200,000 F were deducted annually from net incomes and used to buy back shares from shareholders chosen by lot. Late in 1847 the company's

directors proposed that the amortization period be extended to cover the entire 92 years of the concession, making it possible to reduce the annual amortization payments to only 11,500 F.¹⁰¹ This proposal received the overwhelming approval of the shareholders. The much larger problem of interest payments however, was much more difficult to solve. In the first two years of its operation there was little that could be done. After 1848 an opportunity appeared for the company to improve its position in the broader context of State assistance to several companies whose credit had been destroyed in the financial disaster of that year. By 1849 the social and economic crises seemed to have ended, and industrial production in many sectors had almost returned practically prostrate financially. Late in 1849, in order to get railway construction going again, the government proposed several measures designed to put these companies back on their feet. Assistance was to be offered to companies which had not finished construction, first among them the Avignon-to-Marseille. This was certainly welcomed by the directors of the Rouen-to-LeHavre, but in their view the government should have extended its aid beyond these companies:¹⁰²

Accorder une concession de 99 ans, une subvention de près de 200 millions, garantir un intérêt de 5% à un capital qui s'engage dans l'exploitation productive d'un chemin de fer, dont la construction reste en grande partie à la charge de l'Etat, c'est reconnaître implicitement que si la situation de tous les autres chemins de fer ne peut être assimilée de tous points à celle de cette nouvelle entreprise, le gouvernement doit au moins prendre en sérieuse considération leur détresse et leur embarras.

In this conviction, the company proposed that it be given a guarantee of interest on its entire outstanding capital and, in order to reduce the burden of fixed charges, that the loan of 10MF given by the state in 1842 be converted into a simple grant. Such a measure would have reduced fixed charges by about a third, permitting (as indicated in the graph in Figure 17) a return on equity of about six per cent. Although their proposals were sympathetically received, it was the government's stated policy that assistance would be given only in exchange for new obligations, especially new construction, to be undertaken by the companies. Since in this regard the Rouen-to-LeHavre could offer nothing, it received no assistance.

Fixed charges in connection with debt capital were not alone in creating problems for the company's management. This was made very clear in 1848. It became plainly evident then, if it had not been so before, that there were many elements of total operating costs which were not easily controllable, that in the short run at least were also fixed. For a few weeks after February 1848 traffic between LeHavre and Rouen came almost to a standstill; with four of its bridges and several of its stations either entirely or partly destroyed, it came to a complete stop on the Paris-to-Rouen. However, while revenues fell, expenses did not.¹⁰³ Almost every category of operating expense, except 'traction' itself, which was directly related to the volume of traffic carried, remained close to its normal level. The over-all effect of this is visible in the graph in Figure 18. Though an advantage when revenues rose, stable operating costs became a heavy burden when they fell. The same phenomenon was experienced by the Paris-to-Rouen, though with less damaging effect.

The second major reason for the lower return to shareholders in the Rouen-to-LeHavre was its insufficient traffic. This applied to both passengers and goods, but only the latter were subject to competition. In 1849 for example, the railway seems to have carried a total of about 185,000 tons, for each of which, on average it received about 8F.25, or OF.09 per ton per kilometre of its track. In the same year the Paris-to-Rouen carried more than 275,000 tons for each of which it received about 12F per ton, also about OF.09 per kilometre of track. Owing to its greater amount of traffic however, the Paris-to-Rouen earned a total of almost 24,000 F per kilometre of its line from goods traffic, whereas the Rouen-to-LeHavre earned only 16,000 F. The graph in Figure 19 attempts to show the effects of this lower yield upon the profits of the Rouen-to-LeHavre. Had it been able to earn the same revenue from goods per kilometre as did the Paris-to-Rouen, the result would have been an annual return to shareholders of as much as 6.5 per cent of their equity. However, to do this using approximately the same tariff the railway would have been required to carry about 275,000 tons of goods per year, and for the company to have done so at this stage in its career would have been almost impossible. Already in September 1847 its directors had complained of insufficient

financial resources to handle adequately the 85,000 tons of goods consigned to the railway in its first six months of operation.¹⁰⁴ Complaints were being heard from shippers in Rouen and LeHavre about slow service on the railway.¹⁰⁵ Even without these problems of capacity, much additional traffic would in any case probably have been difficult to attract; the efforts being made by the mariniers admitted the directors¹⁰⁶ had been much more effective than had been expected.. After February 1848, with their finances in a state of ruin, the directors explained,¹⁰⁷ there could be no more thought of active competition, as every effort would be required merely to ensure survival.

CHAPTER EIGHT

The First Stage in Canalization of the Lower Seine

In the two decades following 1840 the first stage in canalization of the lower Seine was completed. When the experiment with the invention of Poirée at the old pertuis de la Morue was finished in 1840, planning for its use elsewhere on the Basse Seine was begun almost immediately. Between 1840 and 1845 the emphasis in this planning changed from a concern to make improvements merely where the volume of navigation was greatest, to where it would be of greatest assistance to the batellerie in its struggle with the railway. At the same time, and for the same reason, planning was begun for major improvements to the Seine-Maritime. The latter project was propelled mainly by constant pressure from the Chambre of Commerce in Rouen, and was in effect its response to what it called LeHavre's railway.

The Programme of 1846.

Construction of the lock and dérivation at Marly was finished in July 1840. It had already been widely recognized that the system of canalization devised by Charles Poirée was a complete success.¹ Among its most enthusiastic advocates were the engineers who worked with Poirée in the Service de la Navigation de la Seine. Some time earlier, in May 1839, the chief engineer for the 3e Section de la Seine, Z.-A. Michal, had proposed that the system be extended to the whole of the Basse Seine,² and more detailed plans were submitted early in 1840.³ Completion of the project produced a minimum depth of two metres over the 23 kilometres between Marly and the entrance to the Canal de St.-Denis, and eliminated one of the most dangerous and time-consuming passages on the lower Seine.⁴ Since this part of the river was upstream from Conflans, the project benefitted all the vessels travelling between Paris and both the Basse Seine and the Oise, which together amounted to over 4,300 boats and 800,000 tons in 1840. There seems to have been unanimous agreement among the

formerly skeptical users of the Seine that the system was a success. This was clearly evident at a meeting of bateliers, négociants and representatives of Chambres of Commerce held at the Bourse in Paris in July 1840.⁵ The savings in time made possible by these first improvements were at least one and a half hours for each passage of a bateau, chaland or péniche du Nord, and the saving in fees to aides and pilotes and to chevaux de renfort was estimated in 1841 to be at least 300,000F per year.⁶

It was clearly desirable to contemporaries that the system devised by Poirée be extended eventually to cover the whole of the Basse Seine. In 1838 the government had outlined its long-range plans for development of the country's waterways, stating that⁷

La prospérité du commerce extérieur exige que les grands bassins qui débouchent à la mer soient perfectionnés, et qu'on fasse aboutir à nos grands ports et sur les points principaux de notre frontière de terre, de grandes lignes de navigation....

Eighteen possible lines of water transport were mentioned, among them one from Strasbourg to LeHavre, comprising a total of over 9,000 kilometres. It was obvious however, that improvements would have to be made gradually, and confined at first to where they were most needed. As military spending increased after 1840, funds available for public works were somewhat reduced.⁸ For these reasons, planning for major improvements on the lower Seine was focused at first upon the most heavily used portion between Conflans and Paris. During July 1840 a proposal was submitted for extensive improvements to the 4e Section by its chief engineer Octave Bleschamps, but nothing came of it.⁹ Michal was instructed by Legrand to draft a preliminary plan concentrating upon the sixty or so kilometres upstream from Conflans. His proposal, which was contained in a report submitted by Poirée to the Conseil-général des Ponts et Chaussées in February 1841, was that four more complete systems of dérivations and épis-mobiles be built, at Andrésy, Maisons-Laffitte, Epinay and Suresnes.¹⁰ Much smaller improvements were proposed for the remaining eighty or so kilometres of the 3e Section as far down as Notre Dame de la Garenne, including more work on the tow paths and construction of a new arche-marinière and épi-mobile at the Pont de Poissy. Similar simple improvements, including dredging, had been completed at Vernon, Meulan, Pecq and elsewhere since 1837.¹¹ Discussion

in the Conseil-général was brief, since at this early stage there was no question of approval, except in principle. The Conseil simply recommended that Michal's proposal be submitted to a public inquiry.¹²

This public inquiry was the first in a series of stages over the next two years in which detailed plans were evolved for two of the most important projects between Conflans and Paris. It was usual for there to be four steps between this stage and the beginning of construction. The first step was preparation and approval (by the Conseil-général and by public inquiries) of an overall 'conceptual' plan, encompassing the whole system of improvements to a waterway. The second was preparation and approval by the Conseil-général of detailed plans for the particular projects to be undertaken in the first stage of improvement. The third was legislative approval of the overall plan and appropriation of funds for the first stage of construction. The last was preparation and approval by the Conseil-général of the detailed working plans for each of the "travaux d'art" immediately prior to building. It is obvious that this could take several years. The recommended public inquiry took place at Versailles late in 1841, and submissions were also invited from the Chambres of Commerce in Paris, Rouen and LeHavre. Though in general the plan put forward by Michal was accepted by the river's users, the Chambres of Commerce complained that it did too little for the 160 or so kilometres from Conflans to Rouen, and in fact nothing at all for the 80 kilometres in the 4e Section. They asked that much more attention be given to the pressing needs of the marine normande, in particular extensive drédging, and reconstruction of tow paths and arches marinières.¹³ Legrand seems to have been reluctant to include any further improvements to these portions of the Basse Seine in his programme for this decade. Nevertheless, he asked Bleschamps to prepare a supplementary plan containing some simple projects for the 4e Section. The plan submitted by Bleschamps included a number of small projects, which he estimated would cost 1.9 MF, most of this for dredging.¹⁴ This plan and the other prepared by Michal were approved by the Conseil-général in July 1842.¹⁵ Detailed designs were then drawn up for the first parts of the project to be built, barrages-écluses at Andrésey and Maisons-Laffitte (to cost 1.9MF) and lesser

improvements to three portions of the 3e Section (to cost about 355,000 F). These were in turn approved by the Conseil-général late in 1843.¹⁶

The expected course of planning then began to change. Gradually over the next three years planning for major improvements over the whole lower Seine was accelerated, so that by 1845 the projects approved for Andrésy and Maisons were joined by similar ones on what had been considered the less important lower reaches of the river. The reason for this was clearly the imminent advent of competition from the railway.¹⁷ Since 1842 concern had been growing both among the mariniers and in the Ponts et Chaussées about the effects this might have upon water-borne transport. In 1842 the Conseil-général asked a group of delegates from the marine normande to one of its meetings to discuss longer term planning for the Basse Seine. The delegates reiterated their support for the programme being undertaken by the government, and hoped that some results would soon be from it. Construction of the Paris-to-Rouen railway was at its height, and they stressed the need for an early beginning on construction,¹⁸

d'autant plus désirable ... que le commerce des transports par eau est menacé d'une concurrence ruineuse par l'ouverture prochaine du chemin de fer de Rouen. Leur industrie doit périr si l'on ne se hâte; l'état actuel de la rivière ne leur permettra de lutter qu'avec désavantage contre la Compagnie de Chemin de fer.

The mariniers wanted more attention paid to the 4e Section than was implied in the small supplementary plan submitted by Bleschamps late in 1841. Some of the most difficult portions of the Basse Seine, they pointed out, lay between Vernon and Rouen.

Accelerated planning for the 4e Section de la Seine began very soon after this. Less than a month later Bleschamps was removed from his position as ingénieur-en-chef of the Section;¹⁹ in his place were appointed two new men, Adémée Méry from Vernon to Rouen, and Auguste Doyat from Rouen to the sea.²⁰ In March 1843 Legrand asked for a report on the proposals submitted by Bleschamps and Michal for the whole of the lower Seine in 1840.²¹ This was followed by special meetings between Michal and Méry to agree upon a set of technical standards for the ouvrages d'art in the 3e and 4e Sections.²² Then both engineers prepared final reports outlining their proposals for the whole of the Basse Seine. They had agreed that the object of any improvements should be to

create a channel with a minimum depth of two metres and minimum width of 30 metres; the number of tow path traversés should be reduced; the tow paths should be raised above the level of highest water; and arches marinières should be rebuilt where needed. Michal proposed eleven dérivations, five of which he recommended for immediate construction (one more than in his earlier plan), plus other works, to a total estimated cost of 7 MF.²³ Méry proposed three dérivations and some other works, to a total estimated cost of 6.9 MF.²⁴ Both engineers expressed some concern that these works be completed soon, though the arguments they used were not the same. Méry was simply concerned that the batellerie be assisted in its struggle against competition from the railway. Michal adopted a more optimistic line. Less costly transport made available by railways he stated, would tend to concentrate more population in Paris, "telle qu'on ne pourra satisfaire à tous les besoins que par le concours simultané des chemins de fer et des lignes navigables".²⁵ This greatly enlarged scheme for the Basse Seine was then presented to public inquiries late in 1844, and to the Conseil-général in February 1845. The Conseil approved five major dérivations, two of them above the Oise, three of them below. Their total cost was estimated at 10.5 MF.²⁶ The barrage-écluse at Maisons-Laffitte, which had been given final approval late in 1843, was cancelled.

Plans were also being made to improve the Seine-Maritime. Since the collapse of the maritime canal company there had been almost no thought given to this. With the great success of remorquage the dangers from the bore and from reefs had been greatly diminished, and shipping accidents had been almost entirely eliminated. Any need for improvements had apparently ended. Nevertheless, as part of the overall planning for waterways which had begun after the law of 12 July 1837, studies had been undertaken on the Seine-Maritime. It will be recalled that Charles Bérigny had sketched out a proposal for canalization of the Seine-Maritime in the early 1820s. The first economical and technically feasible design to be drafted in any detail had been privately published by Pierre Frissard in 1832.²⁷ In 1838 Octave Bleschamps was appointed chief of the 4e Section de la Seine, including the Seine-Maritime, and two years later he submitted an avant-projet.²⁸ During the late 1820s, Bleschamps had spent

four years in the Seine-Inférieure, working part of this time under Frissard, and it is very probable that he took some of the inspiration for his design from the earlier one by Frissard. No action was taken on the proposal of Bleschamps; Charles Poirée was not in favour of his design,²⁹ and in any case, as we have seen, the attention of the Administration des Ponts et Chaussées was focused elsewhere.

In response to strong pressure from the Chambre of Commerce in Rouen, the proposal by Bleschamps was revived in 1843. Support for improvements to the Seine-Maritime had always come almost entirely from Rouen, which saw them as the only means for assuring passage of large ships up to its port; only in this way would it be able over the long term to compete with LeHavre for a share in growing overseas trade. In 1837, during the public inquiries into Poirée's project for the Basse Seine, the Chambre of Commerce had urged the Administration to give more attention to the Seine-Maritime.³⁰ However, while the coasting trade remained safely the preserve of Rouen, inaction could be tolerated. Late in 1843, as construction of the Rouen-to-LeHavre railway was just beginning, the Chambre in Rouen took the first steps in an intensive and ultimately successful campaign to obtain the improvements it wanted. A meeting with the Minister of Public Works in December 1843³¹ was followed in February 1844 by the first in a long series of pamphlets addressed to the Chambres of Deputies and Peers.³² Very quickly these efforts found a favourable response; within weeks Auguste Doyat was asked to have one of his engineers draw up a new avant-projet.

Doyat presented his report at the end of March 1844. The design it contained, by Bouniceau, was very closely modelled, he acknowledged, upon the earlier avant-projet by Bleschamps.³³ The nature of the river here and the engineering solutions required for its improvement were quite different from those on the Basse Seine. The main components of Doyat's design were two parallel dykes, one along the north shore of the river from Villequier to Tancarville and extending beyond to a point opposite St.-Wandrille to Vatteville, and from Aizier to Vieux-Port. To this were added two jetties, one extending a short distance out from the quay at Quillebeuf, the other running from the Pointe de la Roque, toward Tancarville, for a distance of 3,600 metres. (See Figure 21 below.) By confining the river to a narrow and

permanent channel between Villequier and Quillebeuf, it was hoped both to deepen the channel and to eliminate the dangerous shifting 'Traverse'. By forcing the incoming tide into a gradually narrowing channel at the end of the Baie de Seine, it was hoped also that the bore would be reduced and in the end broken up by interference from the jetty at Quillebeuf. With the addition of new tow paths from Rouen to La Mailleraye, Doyat estimated the whole project would cost about 14 MF.

LeHavre was opposed to this plan. Owing to the great size of the estuary and to the complexity of its tides, such a project, though simple in conception, was difficult to design. None like it had ever been built on a similar scale, and the correct dimensions and shapes of the dykes and jetties were very critical to its success. Public inquiries were held in Rouen late in 1844.³⁴ Although the plan received almost unanimous support, there were serious objections stated from LeHavre. The Chambre of Commerce feared that any interference with the tides in the estuary would have adverse effects upon the port of LeHavre; its water level could be raised, and there was a strong possibility that sediments would accumulate around the entrance to the harbour, cutting it off from easy access to the bay. In any case, said the representatives of LeHavre,³⁵ "la navigation maritime ne souffrira pas, par cela seul qu'elle devra aboutir à un point du littoral plutôt qu'à un autre". Although some of LeHavre persistence may have come simply from the spirit of inter-port rivalry, as this quotation indicates, its fears seem to have been genuine. There were also doubts about Doyat's plan among members of the Conseil-général des Ponts et Chaussées.³⁶ Having received the reports from the inquiry, the Conseil-général recommended that only a trial project be undertaken, including only the parallel dykes between Villequier and Quillebeuf, and omitting for the present any works in the bay. Unlike the plans for the Basse Seine which had been drawn up in some detail, those for the Seine-Maritime were still by this time only at the conceptual avant-projet stage. The difficult task of detailed design would come later. With tow paths from Rouen to La Mailleraye, it was roughly estimated that this first test on the Seine-Maritime would cost 3.5 MF.

The government was anxious to proceed with its programme for waterways. Therefore even though it had no detailed plan for the Seine-Maritime, it went to the Chambres to ask for funds. Only weeks later, early in March 1845, Dumon the Minister of Public Works presented a bill requesting 81.4 MF for a large programme of improvements to canals and rivers.³⁷ This was the first major piece of legislation on waterways since 1837, and it was the first outcome of the planning begun at that time. It very soon became evident that the bill would not be passed. The committee nominated to examine the bill believed that a great part of the government's ambitious plans for waterways should be abandoned. Almost 700 kilometres of railway had been built since 1837, and 3,000 more authorized; this fact, reported the committee, "a bouleversé tous les rapports économiques de nos voies de transport...."³⁸ The Administration had already tried to take account of this, not only by accelerating its planning on the Seine and elsewhere, but also by greatly reducing the number and total length of canals in its long-term programme. Transport policy had been the subject of active public controversy for over two decades, but only since about 1843 had there been serious debate over the likely long-term impact of railways upon waterborne transport. It is clear that by 1845 those who believed that the government should continue building canals were in a minority. In 1844 a committee of the Chambre of Deputies had come close to recommending that the new Rhine-to-Marne canal, still under construction, be filled in for use as a railway right-of-way.³⁹ The committee considering the bill submitted by Dumon in 1845 recommended several important amendments and deletions, particularly affecting canals.

Although canals were no longer favoured as an alternative to railways, opinion in the Chambres and among the interested public was not opposed to further expenditure on river transport. Natural waterways had few of the disadvantages suffered by canals, in particular periods of very little or no water in summer, solid ice in winter, numerous locks, and inability to accommodate most steamers. Moreover, transport on natural waterways seemed to have some potential for further development. Wherever railways had been established beside canals, the committee stated in its report of over 150 pages, the canals had quickly suffered very

substantial losses of traffic. In general this had not occurred in competition between railways and river-borne transport; "sur les rivières", the committee stated, "la marine paraît avoir plus de confiance," though on the lower Seine, it admitted, "les faits sont plus incertains". A group of deputies had travelled to Rouen in May 1844 and had seen little evidence of any damage being done to river transport.⁴⁰ However, circumstances had somewhat altered in the year since then, and in May 1845 Henry Maillet-Duboullay appeared before the committee in support of the bill, and to ask that more money be spent on the Basse Seine. Otherwise, he feared, the railway would soon gain a monopoly.⁴¹ The committee seems to have shared this fear, for it stated there was "une véritable urgence à améliorer le plus promptement possible cette ligne de navigation", and it recommended that the whole 10.5 MF requested for the Basse Seine be passed.

The committee opposed the request for funds to improve the Seine-Maritime. Its motives in doing this were quite unconnected with the debate over railways. Though the Minister had received petitions from several coasting ports in support of this project,⁴² he had presented it as a project mainly of local interest, necessary to ensure the future of sea-borne trade in the port of Rouen. Adopting the argument from LeHavre, the committee stated that not only was the project unlikely to be successful in obtaining the results desired, but it might also become a threat to the future prosperity of LeHavre. It believed that the project was being promoted by the Chambre of Commerce in Rouen for entirely selfish reasons, regardless of the possible consequences. "Je crois que la ville de Rouen ne sait pas ce qu'elle demande," said the rapporteur, comte d'Angeville, "elle veut jouer...un va-tout avec le bas de la Seine." Despite a petition to the Chambre of Deputies from the Seine-Inférieure containing almost 7,400 signatures,⁴³ and despite attempts by the Chambre of Commerce to demonstrate the project's potential benefits for the whole economy (which it claimed would be over 2 MF per year),⁴⁴ the committee recommended that this portion of the bill be defeated. In fact the entire bill was abandoned at this stage by the government. It was able only to obtain 500,000 F for the dérivation at Andrésey in the regular budget.

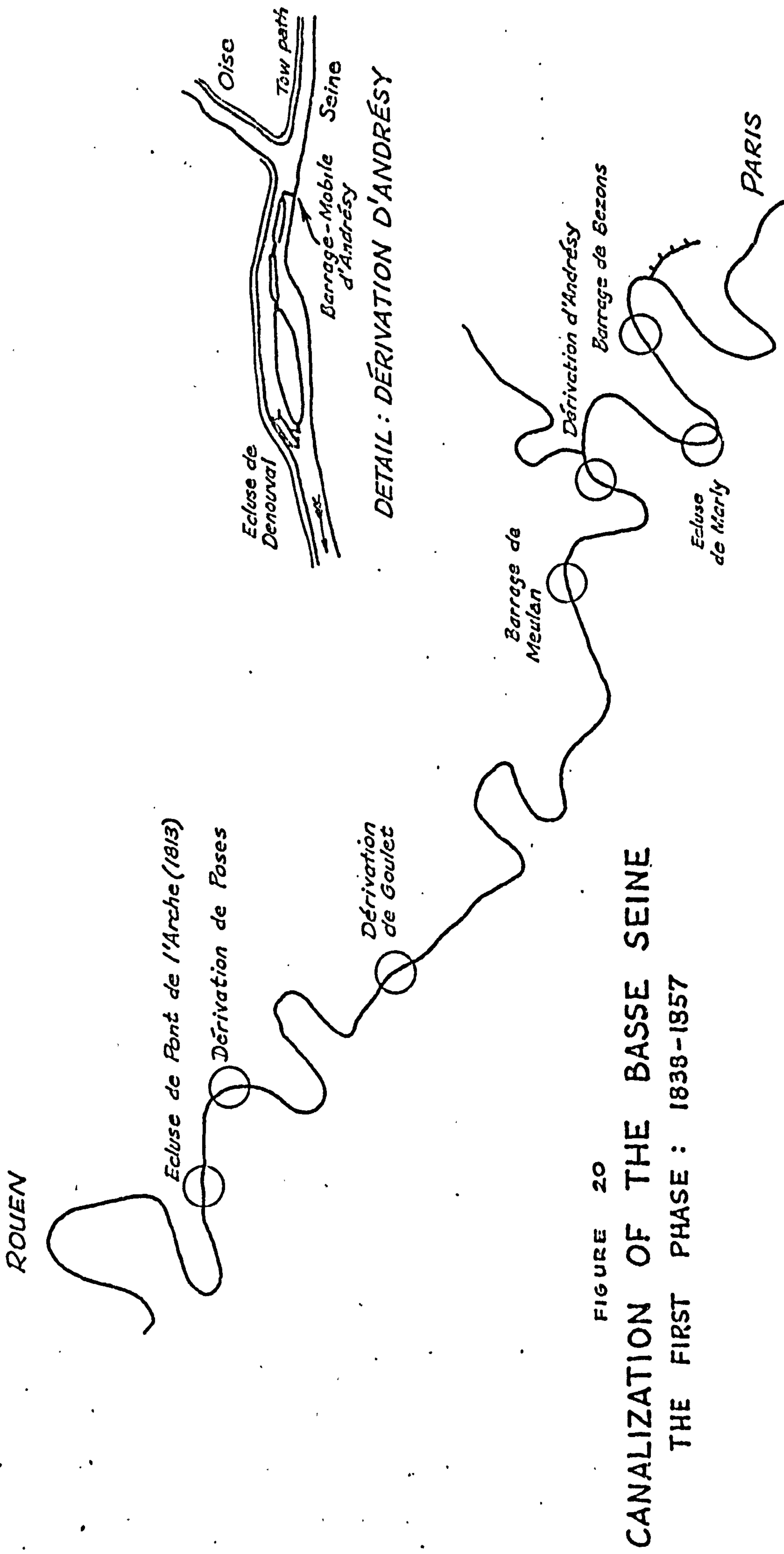


FIGURE 20
CANALIZATION OF THE BASSE SEINE
THE FIRST PHASE : 1838-1857

This was an unfortunate setback for the batellerie, and for Rouen. Confidence among the batellerie had by this time been greatly affected by competition from the railway; it was late in 1845 that negotiations were started between the railway and the marine normande. There was no doubt however, wrote the Minister in response to several petitions,⁴⁵ that the government would reintroduce the bill in the following year. In the meantime it joined openly with the lobby from Rouen to overcome the resistance to improvements on the Seine-Maritime. Directing its attention toward what seemed the most concrete obstacle, it attempted to disprove the technical objections to the project. First it appointed an expert commission nautique, comprising three ingénieurs des Ponts et Chaussées, including Doyat.⁴⁶ Second it encouraged the Chambre of Commerce to send a delegation to Great Britain to view similar projects there, on the Clyde and the Wash, and allowed Doyat to accompany it.⁴⁷ Several pamphlets were published in Rouen, including a lengthy rebuttal of the report by comte d'Angeville,⁴⁸ and several reports on the visit to Great Britain. Discussion of the bill introduced in 1845 was resumed in January 1846, and the commission maintained its opposition to the Seine-Maritime project. However, opinion had changed since the following year. During two days of debate several speakers attacked the alleged unfair and illegal methods of the railway companies; one of the strongest speeches was made by Victor Grandin from Elbeuf, never a friend of the railways. It had often been claimed, he said, that⁴⁹

les chemins de fer...ne doivent être considérés et ne doivent se considerer que comme le complément et le perfectionnement des autres voies de transport Dès le premier jour, le chemin de fer n'a eu qu'un seul but, celui d'absorber à son profit la totalité des transports, voyageurs et marchandises.

Une seule pensée domine et stimule l'activité de ses administrateurs, l'habilité de ses avocats: le monopole!

Even LeHavre seems to have withdrawn its objections to the Seine-Maritime project, perhaps in order to facilitate passage of that for the Basse Seine. Amendments from the Chambre of Deputies added another 300,000 F to the amount passed for the Basse Seine and another one million francs for the Seine-Maritime, and the bill became law on the 31st of May 1846.⁵⁰

Rapid Progress on the Seine-Maritime.

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Rapid Progress on the Seine-Maritime.

During most of this decade, despite the Administration's occasional statements of concern that the waterways be maintained as viable competition for the rapidly spreading and powerful rail-

ways, very little money was spent on them. The number of waterway improvement projects undertaken during the 1850s was very small, and as Louis Girard has pointed out,⁵¹ only one waterway, the Seine-Maritime, received any new appropriations. Most of the impetus for continuing and enlarging the work on the Seine-Maritime came from the Chambre of Commerce in Rouen. At every stage of the work, it exerted pressure upon the government to proceed quickly. LeHavre remained opposed to most of the project, but with its relatively small and very prosperous population, its objections made little impression.

Rouen was greatly aided in the decisive first stage by two factors. The first was the need during 1847 and 1848 to occupy a large number of workers thrown out of their jobs by the economic crisis. The second was the immediate and remarkable success of the first dykes in obtaining their desired object. When the law of 31 May 1846 was passed, planning for the Seine-Maritime had not yet gone beyond a rudimentary conceptual stage. Although the law had opened credits totalling 2.1 MF for expenditure during 1846 and 1847, none of this was spent until 1848. Before any work could begin, a detailed working plan had to be approved. A first draft was submitted to the Prefect in Rouen early in 1847, and the Chambre of Commerce urged the Minister of Public Works that it be quickly approved. Not only, it said, was there an imminent danger from the opening of the new railway to LeHavre, but also⁵²

Nous avons autour de nous tant de bras inoccupés dans un moment où les subsistances sont si chères, qu'il y a véritablement grande urgence à leur venir en aide.

In November the City had opened Ateliers de Charité; by the beginning of March they were supporting more than 3,000 workers, and the City was almost desperately seeking additional means of occupying more.⁵³ The plea from the Chambre of Commerce was supported by the Minister of Commerce. Instructions were given by the Conseil-général in May 1847 for the final working plans to be prepared, and late in November the Prefect of the Seine-Inférieure called together a commission of the river's users to advise Doyat and his engineers on the best course for the dykes to follow. Within weeks a detailed plan was presented to the Conseil-général, and it met late in February 1848 to give them its approval.⁵⁴ Construction began in May; through the summer of

1848 there were over 1,000 workers employed in building new tow paths from Le Croisset to La Mailleraye, and another 700 on the two dykes downstream from Villequier.⁵⁵ By the end of the year 53 of the 60 kilometres of tow paths planned had been completed, and the dykes had already shown themselves completely successful.⁵⁶

Planning was very soon begun to extend the dykes in both directions. Reluctance in the Conseil-général des Ponts et Chaussées to proceed so quickly was easily overcome by the Chambre of Commerce in Rouen. Despite their apparent success in eliminating the Traverse between Villequier and Vacgerie, there was still great uncertainty about what might be the effect of extending them farther out toward the bay; LeHavre remained completely opposed to any such extension. For this and for financial reasons, the Conseil-général wished to proceed cautiously and by easy stages. The projects built during 1848 had cost only two-thirds of the estimated 3 MF, and early in 1849 Doyat's engineers requested permission to use some of what remained to continue the dyke on the right shore another six kilometres from Norville to opposite Courval. At the same time they asked for approval in principle to extend the new tow path from La Mailleraye down to Caudebec, and to build further dykes from Villequier upstream to La Mailleraye and from Courval out to La Roque.⁵⁷ The Conseil-général readily approved the extension to Courval; it also agreed that further studies should be done with a view to improvements upstream from Villequier. Beyond Courval however, it believed that any further study should be postponed. In Rouen it was believed that in order to suppress the bore and to ensure entirely safe navigation across the bay to Quillebeuf and upstream, the dykes must eventually be taken all the way to Honfleur. Upon hearing of the Council's decision, the Chambre of Commerce in Rouen wrote to the Minister and very quickly succeeded in having it reversed.⁵⁸ The Conseil-général then agreed to extend the dyke on the right shore another 6.4 kilometres from Courval to opposite Quillebeuf, and reluctantly advised that public inquiries be held to determine whether and how it should be taken farther.⁵⁹

Rouen was determined that the system of dykes should be extended into the bay to La Roque. Public inquiries were held in the early autumn of 1850 in Rouen and Evreux, and the results were very much in favour of this proposal. Only LeHavre raised any serious objections. The inquiries were also asked whether dykes should be built upstream from Villequier to La Mailleraye, and there were no objections to this. The advantage lay very much with Rouen, and during what remained of 1850 and through 1851 the Chambre of Commerce exploited this by continuing to exert pressure upon the Administration to approve further dyking. A long pamphlet was published just before the inquiries,⁶⁰ and another shortly after them, including extensive extracts from their proceedings and several official reports and other documents. In a preface the President of the Chambre invited his colleagues in other coasting ports to write to the Minister in support of further improvements in the Seine-Maritime.⁶¹ Delegates were sent to Paris to speak to officials in the Ponts et Chaussées and to the Minister. Rouen's only desire, said the Chambre of Commerce, was to secure a fair share of the commerce coming into the lower Seine; it had no ambition to displace LeHavre from its predominant role in overseas shipping. "Au Havre et son chemin de fer, la grande navigation transatlantique," it wrote, "et à la Seine Maritime pour le port de Rouen, tout le petit et le grande cabotage. Il y aura du travail pour tout le monde."⁶²

LeHavre feared that the ambitions of Rouen went farther than this, and that in pursuit of them permanent damage could be done to the port of LeHavre. However, the President of the Chambre of Commerce in LeHavre urged his colleagues,⁶³

il faut, dans cette question, laisser de côté les considérations qui tiennent à la rivalité commerciale entre les deux places et s'attacher principalement au danger que les travaux projetés peuvent faire courir au port du Havre.

These dangers had been strongly stated by Renaud, ingénieur-en-chef for the port of LeHavre, at the inquiry in Rouen. Any permanent restriction and redirection of the river's current to the south shore of the bay (as was planned), would permit gradual accumulation of sand and gravel along the north shore and eventually block the entrance to the harbour at LeHavre. It seemed inevitable in fact, said Renaud, that "l'intérêt des ports de l'embouchure de la Seine est opposé de celui de la navigation."⁶⁴ In February 1851 the Chambre of Commerce sent its own

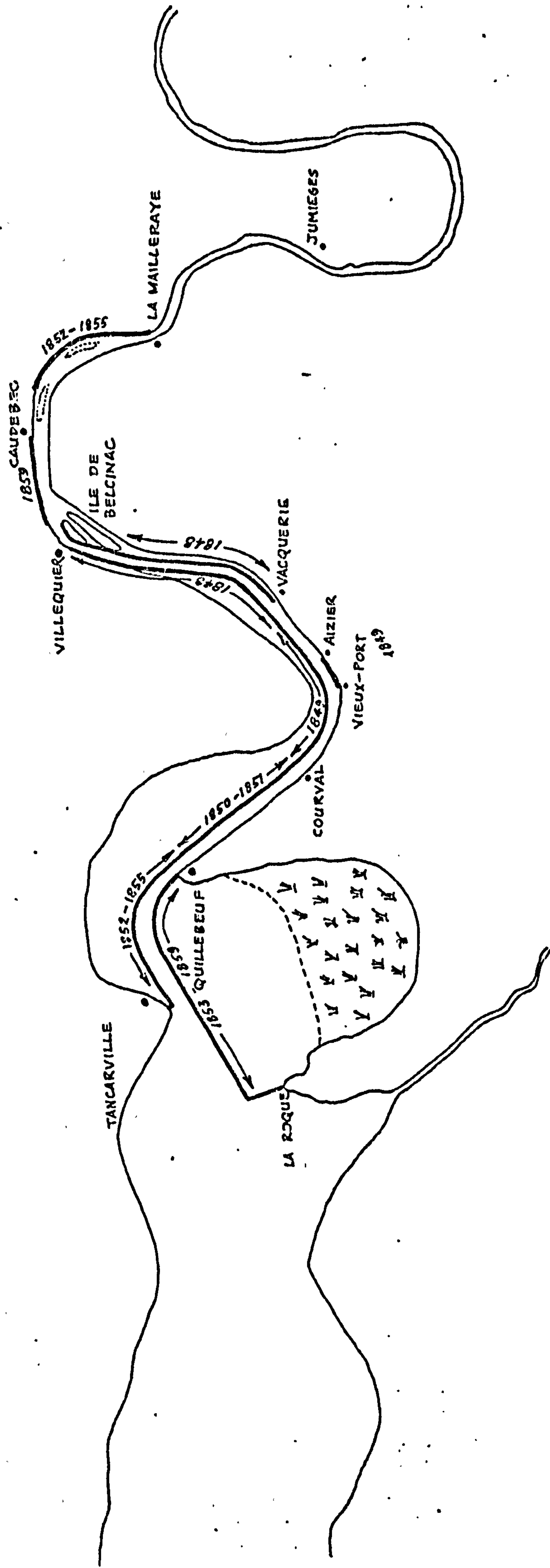


FIGURE 21

LA SEINE - MARITIME

DYKES CONSTRUCTED 1848 - 1859

delegates to Paris, and they seem to have been successful in persuading both de Franqueville, the new Directeur-général des Ponts et Chaussées, and the Conseil-général to delay any further dyking downstream from Quillebeuf.⁶⁵ The Conseil-général based its decision not only upon the continuing uncertainty about the likely effects of further dyking, but also upon the belief that any benefits it might yield would not justify the estimated expense of 4.5 MF. Rouen remounted its offensive. To LeHavre it promised that⁶⁶

en ce qui touche à l'amélioration de la Seine, en désirant y faire monter les navires de fort tonnage qui pourront seuls bientôt soutenir la concurrence avec les chemins de fer, elle serait des premiers si cet amélioration ne pouvait être obtenue qu'en ensablant les abords du Havre, à renoncer à cette élément de prospérité.

As a result of further pressure on the Minister, the Conseil-général partially reversed its decision. It approved extension of the dykes as far as Tancarville, and permitted further study of dykes to La Roque. A decree on the 15th of January 1852 granted 2.8 MF for this purpose.⁶⁷

Pressure from Rouen for more dyking was continuous throughout the decade, and LeHavre continued to oppose it. Another decree in August 1853 granted a further 2.5 MF for extension of the dyke on the south shore to La Roque. Work had to be suspended temporarily in 1856 owing to lack of funds, but by 1860 the dyke was virtually complete. (See Figure 21.) The threat to the harbour at LeHavre failed to materialize, and although the bore began to reappear in 1858, the dykes were considered to have been a great success. Marine insurance rates for ships using the Seine-Maritime fell to one-quarter their former level, transit times were reduced to half, and the port of Rouen began to receive a somewhat greater share of overseas shipping.⁶⁸ The average size of ships in foreign trade entering the port of Rouen during the 1840s had been less than 90 tons; during the 1850s it was almost 110 tons, and in 1860 it rose to 131 tons. The first ships began arriving from America in 1852, including the MARY ANNAH, with a cargo of over 500 tons of cotton; in 1856 the Bordelaise ship LA BRUNE brought a cargo of wool direct from Sydney, Australia. The Chambre of Commerce estimated in 1858, that taking into account both coasting and foreign trade, improvements to the Seine-Maritime made possible annual savings

of between three and four million francs.⁶⁹ Quoting the words of the chief engineer for the 4e Section in 1861,⁷⁰

la Seine présente, sur toute sa longueur, depuis Rouen jusqu'à Tancarville, un véritable canal avec 6 mètres 50 centimètres de profondeur de haute-mer de vive-eau, et 4 mètres 50 centimètres de morte-eau, sur ses passes les plus maigres. L'amélioration définitive de cette partie de la Seine maritime est donc, en quelque sorte, un fait consommé, et il ne reste plus à y ajouter, à titre de complément,... que quelques travaux d'une secondaire importance.

Faltering Progress on the Basse Seine.

There was a sense of urgency about the Basse Seine in 1846. The debate in the Chambre of Deputies in January had indicated this. Competition from the new railway was beginning to show a marked adverse effect upon the batellerie. Moreover, very high water levels on the Seine during the winter had caused serious flooding, and left great accumulations of sand at several places in the channel. Navigation in the summer of 1846 therefore, was even more than usually difficult. In July a group of bateliers petitioned the Minister for immediate dredging of the most difficult passages near Triel and Notre Dame de la Garenne.⁷¹ Steamers were being held up for several days at a time by a newly formed sand bank near Oissel. Local engineers of the Ponts et Chaussées were able to remove it during the summer, first by manual dredging, and later with a steam dredge brought down specially from Mantes. 4,000 F for this job were taken from funds for maintenance of Rouen harbour.⁷² In addition to several other small jobs of this kind, extensive dredging was begun with the funds given for this purpose in the law of 31 May 1846; over 130,000 F were spent by the end of the year.⁷³

Work also began almost immediately on the other projects authorized in 1845 and 1846. There were not the same causes for delay as there were on the Seine-Maritime. The method to be used on the Basse Seine had been tested, and had long before been found successful. Detailed designs had already been prepared for several projects. The dérivation at Andrésy was begun early in 1846 and largely completed in the following year; its cost was 1,004,914 F, only very slightly above estimates. A second dérivation was begun at Goulet (between Vernon and Les Andelys) in 1847, and the new lock there was opened for use in

November 1849.⁷⁴ Its total cost was 1,307,929 F, considerably above the originally estimate. At the same time construction of new tow paths was begun at several places between St.-Cloud and Poses, eliminating most of the former time-consuming traverses. Over one million francs had been spent for this purpose by the end of 1848. Small improvements were made to arches marinières at Aisnières, Meulan, Vernon and Pont de l'Arche.⁷⁵ The pont de Poissy, an old bridge with 23 narrow masonry arches, was partially rebuilt at a cost of almost 400,000 F;⁷⁶ three of the old arches were replaced by a single iron structure over 32 metres wide. By the end of 1850 over half of the total authorized funds had been spent, and by the end of 1853 more than three-quarters.

There seemed to be little doubt about the commitment of the Administration to assisting the batellerie in meeting competition from the railway. The Minister of Public Works, M. Lacrosse, flanked by his engineers, by the Prefect of the Eure and the Bishop of Evreux, spoke at the opening of the lock at Notre Dame de la Garenne in 1849. "Le gouvernement", he said,⁷⁷

tourne tous ses efforts vers le développement des forces productives de la nation, et parmi ces forces on peut placer au premier rang la marine du commerce: ainsi l'amélioration des fleuves doit-elle être l'objet d'une constante préoccupation.

And this assurance was renewed in 1854 by his successor. In a circular to all inspecteurs divisionnaires des Ponts et Chaussées, Magne the Minister of Public Works stated that⁷⁸

le réseau des voies navigables occupe une place considérable dans le système des communications intérieures du pays, et les efforts de l'administration doivent tendre à ce que la navigation conserve, même en présence des chemins de fer, toute son importance et toute son activité.

By the middle of the decade there were six locks in use on the Basse Seine (including the one built in 1813 at Pont de l'Arche) and nine barrages mobiles.⁷⁹ The important dérivation at Poses was given over for use in the summer of 1852, and completed in 1854. The one at Meulan was completed in 1856. A minimum of 1m.50 or 1m.60 was available in all but a very few places, and the length of the seasonal étiage was greatly reduced. Boats of all kinds were carrying 85 to 90 per cent of their maximum potential loads; by 1854 the average tonnage being carried upstream in chalands and bateaux normands was 320 tons, an increase of almost a third since the 1840s. Voyage times for horse-

pulled bateaux normands were reduced from what had formerly been eight to twelve days to only four or five; voyage times for chalands and bateaux pulled by tugboats were reduced from four or five days to only two.⁸⁰ Michal, who in 1847 had been placed in charge of all the 2e and 3e Sections of the Seine, calculated the saving in transport costs brought about largely by these improvements to be about 2.7 MF.⁸¹ The funds authorized in 1845 and 1846 were exhausted in 1857. Although several important projects in the programme had not been built, the improvement had been sufficient to consider it at an end. By 1855 consideration was being given by the Conseil-général des Ponts et Chaussées to a second programme of improvements which would eventually raise the minimum water depth to 1.8 metres.⁸²

Unfortunately unforeseen events during 1857 and 1858 quickly rendered the unfinished programme of 1846 insufficient. However, despite earlier repeated assurances of good will from the Administration, no funds were available until late in 1859. During 1857 and 1858 water levels on the Basse Seine fell to their lowest in 140 years.⁸³ Moreover they did not quickly rise again, and it became evident that levels somewhat lower than in the past would be permanent. Bateaux normands and chalands were forced to reduce their loads to less than half of capacity; average loads fell to only 130 tons in 1858. This natural phenomenon was said to have been aggravated by effects of the dyking in the Seine-Maritime, and near Pont de l'Arche, one of the most difficult passages on the Basse Seine, by construction of a new bridge. To add to the problems of the bateliers, three locks were in need of reconstruction, the old lock at Pont de l'Arche which was only 80 metres long (the newer ones were all 120 metres long), and the two new locks at Poses and Andrésey. On several occasions during 1858 and 1859 the bateliers urgently petitioned the Minister for immediate dredging of the worst of the new haut-fonds, and for some promise that the programme undertaken in 1846 would be completed.⁸⁴ The Minister asked for reports from his engineers on these petitions, and he soon found their voices added to those of the batellerie. They were reduced in 1858 to funds adequate for no more than the minimum of simple maintenance. "Je me borne à signaler cette insuffisance absolu," wrote the chief engineer of the 3e Section to the Minister early in 1858,⁸⁵

bien convaincu, que je suis, que votre excellence reconnaîtra que l'on ne peut pas laisser plus longtemps en souffrance une navigation (la plus importante de France, sinon comme tonnage, au moins comme valeur des marchandises transportées) pour laquelle l'Etat s'est déjà imposé de si grands sacrifices, et qui par le développement qu'elle a pris et le succès de la lutte qu'elle soutient contre le chemin de fer de Rouen, justifie si complètement ce que l'on a fait pour elle.

He indicated there were five projects for dredging costing little more than 100,000 F which had been approved by the Conseil-général, and three more costing another 80,000 F which had recently been presented by his engineers. This relatively small amount of expenditure, he said, would bring an immediate and large benefit. The Minister's only response to these petitions was that while he agreed that additional works were urgently needed, since he had no funds at his disposal for this purpose, he could do nothing.⁸⁶

Fortunately a way was soon found out of this impasse. With the war in Italy ended in July 1859 the Administration could once more turn its full attention to peaceful works. Fresh from the last of his foreign triumphs, the Emperor addressed an important letter to his Minister of State, outlining a new economic policy.⁸⁷ "Le moment est...venu", he declared, "de nous occuper des moyens d'imprimer un grand essor aux diverses éléments de la richesse nationale." Prominent among these were the various modes of transport. "Un des plus grands services à rendre au pays est de faciliter le transport des matières de première nécessité pour l'agriculture et l'industrie...." Therefore, he continued, "le ministre des travaux publics fera exécuter le plus promptement possible les voies de communication, canaux, routes et chemins de fer...." A credit of 750,000 F had already been authorized for rebuilding the dam at Andrésy.⁸⁸ Dredging was renewed, and in 1861 a decree granted the funds necessary for construction of the long planned dérivation at Martot.⁸⁹ This was the beginning of a new programme to raise the minimum water level to two metres. After 1880 the so-called Plan Freycinet raised this to 3m.20, the present minimum depth on the Basse Seine.⁹⁰

CHAPTER NINE

New Sources of Competition, 1850 to 1860

As the economic crisis came to an end in 1849 and 1850, goods and passenger traffic along the Seine revived. Through the early years of the new decade both rail and water-borne transport experienced almost unbounded prosperity. Though severe competition continued, the bateliers regained some of their lost self-confidence. Since 1848 they had been able to organize themselves for better defence against the railway, and with improvements being made to the river and signs of further important innovations in steamer transport, the future seemed to promise better things. For the railway companies the outlook was clearly not so bright. There was the prospect of increased competition from their rivals on the river, and new competition from other railway lines. Both became really effective after about 1854. By 1860 what might be called the first phase in 'modernization' of the transport system in the lower Seine valley had been completed.

Prospects for the New Decade: the Railway Companies.

Despite the severity of the economic crisis in 1848, it was not of long duration. In the spring of 1848 all the operators of transport in the valley of the Seine had suffered very large reductions in the traffic and revenues, and for the railway companies these had been aggravated by destruction of bridges and stations between Paris and Rouen. Their financial situations, especially that of the Rouen-to-LeHavre company, had been precarious. Nevertheless, by the beginning of 1849 traffic and revenues were returning to near their old levels. The opening of the branch line from near Rouen to the port of Dieppe in July 1848 undoubtedly helped in this recovery. More important was the general economic recovery which began in 1849. The foreign and coasting trades of France, which can probably be taken as approximate indicators of economic activity, began a very strong revival in 1849. In the words of a négociant in

LeHavre, this was a year "signalée par une prospérité commerciale dont le passé offre peu d'exemples".¹ The revival continued through 1850, though there was a setback in 1851. Finally, in 1852 prosperity returned "avec un élan extraordinaire et soutenu",² pulling the volume of trade and transport back up to the level of the good years before 1848.

Although both traffic and profits began soon to return to normal levels, it must have been clear to the directors of the three railway companies that their prospects for the coming decade were not so bright as this early return to normality seemed to indicate. Competition in this new decade promised to be more difficult. Not only did both of the old sources of competition, road and inland water transport, still remain, but it was clear that new and even stronger ones were about to appear. Steps had been taken in 1849 to eliminate the last vestiges of direct competition from the rouliers. However, inland water-borne transport, while showing signs of weakness in 1849 and 1850, still remained a strong rival. Indeed, one of the principal threats to the continued growth and profitability of the railway companies came from water-borne transport. In 1851 the newly formed Cie Pieau began to build and operate a fleet of fast new cargo steamers, first between Paris and Rouen, and later to LeHavre and beyond. The most obvious challenge to the two principal railways in the Seine valley came from the many other railway lines which were being completed during the late 1840s and the 1850s. By promising to provide speedy and economical overland transport, these new railways threatened to eliminate a large part of the domestic coasting trade flowing through the ports of Rouen and LeHavre. The same threat had begun to worry the courtiers de commerce at LeHavre in 1849; LeHavre's natural advantage over other ports owing to its closeness to Paris, they said,³

a cessé à l'égard de plusieurs et va cesser pour les autres par l'établissement des chemins de fer. Déjà vous avez vu les lignes de paquebots pour le Nord disparaître après de longues années de possession, parceque les affaires de ce genre sont maintenant à Dunkerque. Dieppe s'est emparé des bois du Nord, des charbons, et les liquides qui nous venaient du Midi prennent de plus en plus cette voie qui ne tardera pas à leur être exclusive. Cherbourg se prépare à devenir l'Entrepôt de la Manche. Les produits de l'Espagne et du Portugal vont maintenant à Nantes. Le cabotage avec Bordeaux et Marseille disparaîtra entièrement quand la

communication directe avec la capitale sera en activité. New lines had been opened to Boulogne and Dunkérque on the Channel coast in 1848, and to Calais in 1849. To the south a line had for several years been making its way along the Loire to the sea; it had reached Saumur in 1848, Angers in 1849, and finally Nantes in 1851. This completed over 440 kilometres of line from Paris to the port at Nantes. At the same time another line was being built southward from Tours to Poitiers, and northward from Bordeaux to Angoulême. When the gap between Poitiers and Angoulême was filled in 1853 it completed almost 600 kilometres of line joining Paris overland with yet another port on the Atlantic. Two years later the connection was made between Paris and the Mediterranean.⁴

There is no doubt that it was obvious to the directors of the three railway companies that if an economic rate of return on their shareholders' investments were to be maintained, careful and aggressive management would be needed. Profits were the net result of both costs and revenues, and the directors pointed their attention toward improving both. Their efforts to reduce costs met with only light success. We have already seen the unsuccessful attempts made by the Rouen-to-LeHavre company after 1848 to reduce the heavy burden of fixed charges which resulted from its high construction and land costs. Reducing operating expenses proved to be almost as difficult. In 1848 the directors of the Paris-to-Rouen had stated their determination not to authorize any additional expenditures except those absolutely required for continued operations.⁵ Some economies were brought about when this company took over operational management of the branch line to Dieppe, and lower expenses for personnel were made possible by transferring the responsibility for track surveillance to the maintenance function. In 1850 however, both the remaining independant companies were compelled to agree to an increase in both operating and maintenance rates in new contracts with Buddicum and Co. and with MacKenzie and Brassey.⁶ This probably almost eliminated the beneficial effects of the economies already achieved. Overall the companies' managers were fairly successful. Slightly more efficient operation during the 1850s is indicated by a small improvement in operating ratios.

That for the Rouen-to-LeHavre company improved from an average of about 52 per cent before 1848 to about 46 per cent after 1848. That for the Paris-to-Rouen improved from an average of about 48.5 per cent to about 45.5 per cent.⁷

More of the directors' attention was focused upon their market and the revenues it provided. The level of revenues was perhaps more easily changed, and profitability was probably seen to be more closely related to the level of goods and passenger traffic and revenues than to the variable cost per unit of output. The same aggressive methods of pricing as had been adopted in the previous decade were continued by both companies in the 1850s, and in the effort to combat the increasing number of their competitors, some new ones were added. To these were also added other non-price devices to help in seizing and holding a share of the market.

Careful analysis of the companies' performance indicates that the closest link existed between the volume of their passenger revenues on both lines moreover, were usually greater than those from goods. For some time there had been no strong competition for passengers at any of the points served by the companies' lines. The railways had absorbed most of the market for passenger transport, and to attract any large number of additional passengers would be difficult, except perhaps by offering considerably reduced fares. In fact, this is what the companies attempted to do. Even with much reduced fares for some passengers, the revenues earned from them could be sufficient to cover their direct transport costs and make a small contribution to overheads. The variable cost per passenger was quite low (see Chapter Seven, note 95). Special low fares were offered on excursion trains to Dieppe and elsewhere.⁸ To secure a larger and more stable market to points beyond its lines, the two companies made agreements for correspondence with the passenger steamers from LeHavre to Caen and Morlaix. The companies' main source of competition was from other lines carrying passengers to other ports for cross-channel travel. In an effort to retain a share of this traffic, agreements were made in 1849 with both the London-to-Southampton and the London-to-Brighton railways, and special low rates were offered over both routes.⁹ Despite these efforts however, with the gradual improvement of service

by way of Boulogne and an end to the large movement of passengers occasioned by the Great Exposition in London during 1851, most of this traffic was lost.¹⁰ Competition was almost equally difficult for the large numbers of emigrants travelling to America. The number of emigrants embarking at LeHavre had been quite large in the 1840s, and rose to over 39,000 during the famine year of 1847. Their numbers continued to climb in the 1850s, with about 50,000 in 1851 and almost 100,000 in 1854.¹¹ London, Liverpool, Antwerp, Rotterdam and Bremen were strong competitors for this traffic, despite what seemed to be LeHavre's natural advantages of close proximity to south Germany where many of the emigrants originated. To strengthen itself against these arrivals, agreements were made by the railways both with the Chemin de fer de l'Est and with commercial emigration agents. For example, the Cie Favier, Gervais et Voinier of Nancy guaranteed the railways 25,000 emigrants per year during five years for embarkation at LeHavre. They were charged three francs from Mannheim to Strasbourg; and 30F from there to LeHavre; the regular fare for the journey from Strasbourg to LeHavre was 44F.45.¹²

Similar methods were used to attract and retain goods traffic, and these became the object of heated controversy. Although changes were made in the pricing policies used in the 1840s, their central feature remained 'price discrimination'. Price discrimination of one sort, by commodity type, had been practised by both companies from the beginning, and was sanctioned by law in their cahiers des charges. However, the use of this device provoked much more controversy in this decade than it had in the forties. The basis for price discrimination is quite simple, and so was the reason why the railways could so readily use this means of competition. It can be defined briefly as the sale of commodity or service at more than one price. Of course the seller must be able to divide his market into segments, and in markets characterized by imperfect competition, such as those faced by the transport industries, this has often been possible. In each of these separate segments of the market prices are based primarily upon what the buyer, or shipper, is willing to pay, rather than upon unit cost. In other words, they are based upon the value of service rendered. The simplest kind of price discrimination was practised between commodities of differing values; a low-valued commodity such as coal could only be carried at low

rates, whereas a highly valued commodity such as manufactured textiles could easily be carried even if charged a fairly high rate. For railway companies this was just sensible pricing policy, for it allowed them to carry many more goods and earn more revenue than if they had charged a single rate to all. Discrimination could also be made to apply to various destinations, depending upon the existence of competitors, and to shipments of varying size. Some shippers of course would be charged rates higher than average variable cost, while others who would not ship except for less, would be charged less. The range over which prices could be varied was determined to a large degree by the structure of the railway companies' costs. Where the variable cost of carrying a ton of goods was low in relation to total cost, there is a wide range over which rates can vary — and very low rates charged where there is competition — while still having every ton carried meet its direct costs and contribute some amount to fixed costs.

All the necessary conditions existed for price discrimination to be practised by the railways operating in the Seine valley. First, their market was easily separable in several ways. Second, analysis of the companies' cost structures indicates that their variable costs of operation were proportionately low. (See Chapter Seven, Note 95.) Price discrimination by commodity types was not the only kind which had been used before 1848. Granting by the railways of special discounts to shippers of large quantities had been pointed out several times by the Chambre of Commerce in Rouen, as had distance differentials. Both of these were continued and broadened in application during the fifties. As other lines were completed, some of these rates were designed to attract traffic to the port of LeHavre which might otherwise have gone to other ports; being midway between LeHavre and Paris, Rouen suffered particularly from this practice. "Tarifs de détournement"¹³ were another device used to penetrate farther inland and to defeat competitors in road and water-borne transport. Since railway lines almost all radiated from Paris, the distance between two points on different lines might be much greater following the tracks than by a direct lateral route. In order to forestall potential competitors for traffic between these two points, railway companies acted in concert to set rates

based upon the lateral rather than the real railway distances. The first of these was between the Chemin de fer du Nord and the Paris-to-Rouen in 1847.¹⁴ Raw cotton for example, was transported from LeHavre to Lille for only 39F.50, whereas normally it would have paid 52F.75. As successive sections of the Chemin de fer de Ceinture circling Paris and joining the various radial lines were completed, such agreements became easier and more common. Agreements were made with the Cie d'Orléans in 1854¹⁵ and with the Cie de l'Est in 1856,¹⁶ and the rate reductions were considerable. Another variation upon these distance differentials were the "tarifs de transit" or "tarifs internationaux", designed to give attractive reduced rates for long-distance traffic from ocean ports to points in south Germany and Switzerland. In this period there were also the so-called "tarifs particuliers" (called "tarifs de faveur" by their opponents), several examples of which have already been cited from the years before 1848. In the 1850s the companies also continued their aggressive policy of frequent changes in rates and rearrangements of the classification system. From 1848 to 1860, seven more significant tariff changes were made; in 1854 there was a complete change in the system of classification leaving only two classes, instead of the previous six.¹⁷

Inevitably these pricing devices provoked hostility, but though it became increasingly widespread, it did not seriously affect the railways until later in the decade.¹⁸ In the climate of republican sentiment which had followed the journées of February 1848, the railways had come close to nationalization, and though that threat was soon ended in the June reaction, hostility toward the companies remained. It came both from small-scale water transport operators and companies, and more importantly from some of the Chambres of Commerce. There is no evidence however, that the issue was an important one in Rouen and LeHavre during the early 1850s. Rouen's long-standing conflict with the railway companies seems to have subsided for a time. Once recovery from the economic crisis had begun, the prevailing mood in Rouen seems to have become one of optimism, and the Chambre of Commerce was occupied principally with its efforts to have the Seine-Maritime improved and to organize a successor to the defunct Cie Rouennaise de remorquage. Nor was the issue a live one in LeHavre. This was owing in part no

doubt to the fact that LeHavre benefitted from some forms of differential tariffs. Early in 1852 the Chambre of Commerce in LeHavre received a complaint against the railway from a certain Vigot, a commissionnaire de roulage and forwarder in LeHavre.¹⁹ He complained that the company was giving special low rates to some of its users and not to others. Far from the immediate reaction of hostility toward the company which seems to have been habitual in Rouen, the Chambre in LeHavre agreed that it seemed hardly possible²⁰

de contester aux chemins de fers le droit d'abaisser leurs tarifs, ce qui en définitive, tourne au profit du Commerce en lui procurant des transports à meilleur marché.

On looking farther into the matter it became apparent that there had indeed been some unjust discrimination, but in writing to the Minister asking that this be corrected, the members emphasized that these "tarifs à prix réduits" were designed in this case to compete with the Chemin de fer du Nord, which used the port of Boulogne, and that for this reason they were essential to LeHavre's continued prosperity.

This position seems to have agreed well with that of the Minister and his Administration. During an inquiry into differential tariffs by the Conseil d'Etat in 1850, Legrand, who was still Directeur-général des Ponts et Chaussées, had defended their use by the railways. While not agreeing with Adolphe Thibaudeau of the Paris-to-Rouen, that the railways must have "la liberté absolue, illimité, dont jouissent tous les industries"²¹ he stated that²²

Les prix différentiels sont la base de toutes les opérations des industries de transports. Interdire ces tarifs différentiels, c'est paralyser cette industrie, et je le déclare, sans tarifs différentiels, vous ne trouverez pas de compagnie qui se charge d'exploiter vos chemins de fer.

He pointed out that despite a certain opposition to them, distance differentials had been specifically authorized in several cahiers des charges since 1843. As for agreements between railway companies and shippers, Thibaudeau stated that it would be very difficult in practice to prevent them. The government evidently agreed with this. A few weeks later when the mariniers complained to Bineau, the Minister of Public Works, of the increasing number of "traités de faveur" being made by the railways,

he replied that such agreements were merely part of "une concurrence qui est dans la nature même des choses....tout ce qu'(e je peux) faire c'est de veiller à ce que cette concurrence soit sincère et légale...."²³ The matter was at least temporarily resolved in 1852, though certainly not to the advantage of the mariniers, by putting this principle stated by Bineau into legislation. During lengthy parliamentary debates in 1851 and 1852 the so-called "Kestner Amendment" was inserted into the law of concession of the Cie de l'Ouest, stipulating that special low rates made available to individual shippers must be made available to all others on the same terms. An arrêté of July 1st, 1852 extended this requirement to all other companies.²⁴ More extreme suggestions such as that which appeared in the Journal du Havre in 1850, that the government impose minimum limits upon railway rates to protect water transport,²⁵ got nowhere. The railways were left relatively free therefore, within the wide limits of the law as enacted in the forties and the arrêté of 1852, to continue their campaign of attrition against the batellerie. Later in the decade the controversy revived and more severe restrictions were imposed upon the railways.

Prospects for the New Decade: the Batellerie.

For the mariniers de la Seine the economic crisis had been very serious. As we have seen, their traffic was reduced to a fraction of its level in 1847. Traffic levels were well on their way to full recovery during 1850, and the river continued to carry more goods than its rival the railway, both upstream and down. Even by the middle of 1850 however, in the words of a well-informed commentator, the batellerie remained "au paroxysme du crise".²⁶ The source of their continued crisis was low rates, still being forced down by unrelenting competition. Average rates for river transport from Rouen to Paris were forced down to as low as 9F.09 per ton in 1850, while evidence indicates that operating costs on the river had changed little since the 1830s, when rates had been 25 to 50 per cent higher. During 1848 many of the independent bateliers normands had been forced temporarily to suspend operations, and in 1849 and 1850 several tugboat operators had been forced to withdraw all or part of their services from the Basse Seine and the Seine-Maritime. This had left only four large companies operating on the Seine.

Despite the continuing crisis in water-borne transport, there were signs by 1850 of optimism about the future. The batellerie continued to carry more goods than were carried on the railway. Four tugboat companies had survived the crisis, and were responsible for an increasing proportion of the total goods transported from Rouen to Paris. The majority of the bateliers normands had survived the crisis, though with much reduced incomes. Moreover, by the early 1850s, it began to seem that some of the handicaps which had been suffered by the batellerie during the 1840s could over time be considerably diminished. Even by 1849, according to Louis d'Artois, editor of the Moniteur de la Marine and one of river transport's strongest defenders, the common view of its prospects were beginning to change.²⁷

...On ne la considère plus comme une industrie impuissante et usée que doit tomber sous la moindre effort des chemins de fer.

Cette modification dans l'opinion général est due d'abord aux ressources réelles, immenses, que renferme la navigation, ressources dont la marine elle-même ne se doutait peut-être pas, découragée qu'elle était par la perspective de ruine et d'anéantissement qu'on ne cessait de lui montrer, par l'abandon et le dédain dont elle est l'objet, par le vertige que entraînait tous les esprits à la suite des chemins de fer.

One of the greatest handicaps suffered by the batellerie had been the unimproved channel of the Seine. In the opinion of Louis d'Artois, one of the main reasons for the gradual revival of confidence among the bateliers was the visible progress being made in canalization of the Seine. This progress was due principally, he said,²⁸

aux hommes sages que l'engouement général (for railways) n'a pu aveugler, que l'expérience et la véritable science en ont préservés;...il est dû aux ingénieurs, qui, loin de désespérer de la navigation, de la regarder comme devant être détrônée, annihilée par les chemins de fer, ont compris qu'il y avait chez elle des éléments de vie et de force que ceux-ci ne détruiraient pas....

By 1850 two major dérivations had been completed at Andrésey and at Goulet, and good progress was also being made on the Seine-Maritime. Of course, water-borne transport would for some time remain handicapped relative to the railway owing to the lack of a complete network of adequate waterways.²⁹ This became particularly evident later in the decade as gradual completion of the

Chemin de fer de Ceinture provided easy direct connections among the major railway lines.³⁰

The second greatest handicap suffered by the batellerie was its very dispersed and artisanal structure. Steps were also being taken to reduce the effects of this. The railways by their nature were highly concentrated in ownership. Water transport was technically very different; the waterways, in the words of Louis d'Artois,³¹

...appartenant à tous, ouvertes à tous, sont exploitées par un grand nombre de compagnies ou d'individus, agissant isolément, à leur façon, sans accord, sans harmonie.

In 1848 approximately 140 bateaux normands and chalands were actively operated between Rouen and Paris by no fewer than 45 owners; the largest of these, LeNormand-Baudu et Cie, owned only 29 of them, in addition to five of the 21 active steamers and tugs. By 1850, when traffic had risen again to almost 200,000 tons, there were approximately 200 boats in operation, spread among some 85 owners; of these the largest operator, still LeNormand-Baudu, owned 39.³² The extreme degree of dispersion indicated by these figures had for a time been diminished somewhat by the existence of several loose associations or companies of maîtres marinières; the only one of these which had survived until 1850 however, was the Compagnie Fleury, bringing together fifteen owners of one and two boats each.³³ Others, like the Cie Blanchon and the Cie Lacour-Deriberprey, had by this time gone a step farther by associating themselves more or less closely with tugboat companies, especially the Cie des Aigles (also known as the Cie Delabrousse). The tugboat companies themselves were also quite unconcentrated, as their number indicates, although such expedients as the abortive Cie de l'Union went some way for a while toward improving this.

The first result of such an industry structure was that the bateliers tended to compete among themselves as well as with the railway. Once more in the words of Louis d'Artois,³⁴

...les éléments dont se compose le corps des marinières et entrepreneurs de transport par eau...l'empêche de se soumettre facilement à cette unité d'action qui favorise si puissamment les progrès de la marche envahissante des chemins de fer.

It had been possible in the past for water-borne carriers to come together to set tariffs, but such arrangements had lasted only for limited periods. This had occurred in 1842. The Cie

de l'Union had been formed partly for the same purpose in 1846. These agreements had a strong tendency however, to break up when subjected to strong pressure, such as had occurred when the railway first began operations or when the crisis of 1848 greatly reduced total available traffic. The rates set by water-borne transport in response to those set by the railway tended to be lower than necessary to retain a reasonable share of the total traffic. In 1848 for example, when the railway lowered its rates so that total shippers' costs between LeHavre and Paris were between 21F and 22F, competition among themselves to secure what remained of the traffic in that crisis year forced the bateliers rates down to as low as 16F per ton.³⁵ Moreover, lack of co-ordination, in the words of Louis d'Artois, would have helped to avoid "les longs séjours que nécessite une charge cueillette, laissant leur meuble inutile pendant un temps souvent beaucoup trop prolongé."³⁶ The lack of capital resources affected the bateliers ability to innovate, though the largest of them was able to expand and innovate to some degree in the early 1850s. Innovations had to await the entry of new companies with outside capital.

Efforts had already been started in the forties to reduce these handicaps, most important among them the well-known improvements to the Seine, and the organization of 'réunions syndicales' for a more systematic defence of its interests. This was certainly the most readily obtainable remedy for the handicap of structural dispersion. A réunion syndicale had been formed in Paris as early as 1845, and during the early days of the Second Republic its scope was enlarged to form a "Syndicat national de la Marine".³⁷ It seems to have been composed mainly of the larger companies operating on the Seine and elsewhere; LeNormand-Baudu, Muleur and Dally (of the Cie des remorqueurs parisiens), and the Cie des Aigles were all members. One of its most important activities was publication of the weekly Moniteur de la Marine, edited by the secretary of the syndicate Louis d'Artois. One of his most constantly reiterated messages was the imperative need for greater "unité d'action" among the bateliers. Taking up his call the bateliers du Nord, who operated on the Oise and the canals of the north of France and Belguim, formed an association early in 1850.³⁸ The bateliers normands

had tried and failed to do the same at the end of 1848.³⁹ With the improvement of conditions over the next two or three years they succeeded in 1852 in forming the so-called "Réunion syndicale des mariniers et propriétaires de bateaux de la Seine et de l'Oise".⁴⁰ Meetings were to be held by the syndicate each month, and aside from conciliating disputes among its members, promoting their knowledge of the regulations governing the use of these rivers and bringing together relevant documentation, the syndicate would also act in defence of its membership by informing the Administration of their needs, and persuading it to adopt policies to meet them. These were approximately the same functions as had been performed with some success by the Syndicat national since 1848.

Fundamentally, success in competition meant prices (and costs) lower than those on the railway, and transport speeds higher than those on the railway. To achieve success therefore, not only must costs on the waterway be reduced, but also prices on the railway must be kept from descending any farther. The Syndicate continuously lobbied the Administration for stricter interpretation and enforcement of the railway's cahiers des charges, demanding an end particularly to all forms of price discrimination. Every effort was made by the bateliers to obtain elimination of charges or undesirable operating procedures imposed upon them by the Administration. This was a constant theme in the Moniteur de la Marine. With a few exceptions however, these efforts were unsuccessful. Permission for night lockages was obtained in 1850.⁴¹ Relief from the droits de navigation, from plombage de douane, from payment of fees to gardes ponts at railway bridges and pilots in the Seine-Maritime were refused.

Two successful defensive actions were fought to prevent increases in existing competition facing the batellerie. The tugboat companies defeated an attempt by the Chambre of Commerce and City Council in Rouen to promote establishment of a replacement for the old Cie Rouennaise de remorquage.⁴² More important was the defeat of a proposal for an entrepôt du chemin de fer at LeHavre. For some time LeHavre had been short of space in its customs warehouses. The City, which administered them on behalf of the Douane, had been forced to lease extra space in

1834 and again in 1844.⁴³ For various reasons these arrangements remained insufficient, and two years later when the Rouen-to-LeHavre railway was shortly to begin its operations a proposal had been made to construct a further succursale de l'entrepôt immediately adjacent to the railway's terminus. Put forward by a local land developer, M. de Mondésir, it had also had some financial support from the railway company and from the Banque du Havre.⁴⁴ The Chambre of Commerce and the City Council in LeHavre were both generally sympathetic to the idea, but they had feared it might promote the development of a railway monopoly. In the financial turmoil caused by the journées of February 1848 both Dubois of the Banque du Havre⁴⁵ and de Mondésir were forced into bankruptcy, and nothing further was heard of the scheme for more than two years. In 1850 it resurfaced,⁴⁶ this time with strong support from both the City Council and Chambre of Commerce,⁴⁷ but with equally strong opposition from the Chambres of Commerce in Rouen and Paris and the Syndicat national de la Marine.⁴⁸ They also feared that control of the entrepôt by a company so closely allied with the railway would give it excessive power, and would simply be another stage in the development of a railway monopoly. It would introduce another means by which the railway could control and impose 'accessory charges' not subject to administrative sanction. In particular, it would be a means of lowering still further the total cost of railway transport. A bitter debate ensued between the supporters of the railway and the defenders of the batellerie.⁴⁹ Following petitions from the batellerie to the Minister of Commerce and vehement opposition by the Syndicate expressed in the Moniteur de la Marine, a special commission was established to study the matter.⁵⁰ Six weeks later the Minister announced on behalf of the government that in order to maintain a balance of competition between rail and water it had decided not to permit the establishment of the entrepôt.⁵¹ This was an important victory for the batellerie. It prompted the directors of the Rouen-to-LeHavre railway to complain, with considerable exaggeration, that "toutes les fois qu'une question se présente dans l'intérêt du chemin de fer, elle est décidé par le gouvernement dans l'intérêt de la navigation..

Innovation in River Transport: a Second Stage. Probably the most powerful and best reason for a revival of confidence in water-borne transport was evidence of continued potential for technical innovation. All of the measures described above, which were designed either to reduce the cost of water transport or to prevent any further reduction in the cost of railway transport, were in the long run insufficient to enable the batellerie to prosper. This was clearly shown later in the decade. Much more radical means than these were required, and when in fact they appeared, their successful development contributed to the revival of confidence. The most effective way to reduce the cost of water-borne transport would be through major increases in productivity made possible by technical innovation. There had been a few attempts in these years to improve the performance of water-borne transport. During 1848 the Cie des Aigles and others had increased transport speeds slightly, and in 1851 the Cie des remorqueurs parisiens introduced a new system of winches for pulling its boats through the Canal St.-Denis.⁵³ These improvements were small at best, and contributed little to increasing the competitive strength of water transport. What was needed to increase productivity was considerably more speed, but without a large increase in operating costs. Such an increase in productivity had been produced in the first stage of innovation during the 1820s with tugboats, and by the early 1850s this system had been extended to at least three-quarters of the goods moving from Rouen to Paris by water. Further increases in productivity by tugboats seems not to have been possible in the 1850s. They had reached their limit of load-pulling capacity, and their only chance was therefore to increase their speed; long trains of three or four chalands per tugboat however, and use of locks after 1840 stood in the way of this.

Late in 1851 a new type of steamboat began to appear on the lower Seine, the so-called PORTEURS; they were light, lightly-powered and fast. In December 1848 Gâche frères, a company of shipbuilders in Paris and Nantes, had secured a patent for a new type of steamer,⁵⁴ but in the economic crisis which followed its exploitation was delayed for over three years. Early in 1851 a

group of Paris merchants led by Charles Pieau formed a new company for this purpose.⁵⁵ The PORTEURS, built by Gâche frères in Paris, were faster than any steamers previously used on the Seine. They were light, with very small engines of only twenty to thirty horsepower (compared with 60 to 140 for the tugboats), and of comparatively small payload (80 to 100 tons compared with 200 to 500 tons for chalands).⁵⁶ With relatively shallow draft and much smaller size than the long trains of chalands, they were able to travel from Rouen to Paris in less than thirty hours, compared with 65 or more for chalands, and three or four days for bateaux halés.⁵⁷ Improvement of the river channel also contributed considerably to year-round reliability and to cargo capacity, and despite their small size, owing to their very much greater speed, they were able to achieve a high rate of productivity and relatively low operating costs. In 1854, for example, when there were between nine and twelve PORTEURS on the Seine, each was able on average to perform over 1.2 million ton-kilometres of goods transport, compared with about two-thirds that by the older chalands.⁵⁸ PORTEUR NO. 1 began operating from Rouen to Paris

Table 10

Comparison of Productivities of Chalands and PORTEURS, 1854.

	<u>Chalands</u>	<u>PORTEURS</u>
number in use	51	11
trips per boat per year		
those operating LeHavre-Paris	5	35
those operating Rouen-Paris	12	60
tons carried per boat per year		
those operating LeHavre-Paris		3,900
those operating Rouen-Paris	3,060	4,500
ton-km. performed in 1854, total		
LeHavre to Paris	11,860,000	4,850,000
Rouen to Paris	29,700,000	8,700,000
average ton-km. performed per boat	815,000	1,200,000

late in October 1851, and in the few weeks remaining in that year made 25 trips between Rouen and Paris, carrying almost 1,300 tons of goods.⁵⁹ Traffic rapidly increased, and four more boats of the type were introduced in 1852, four in 1853 and a further three in 1854. Until the end of 1852, the PORTEURS seem to have confined their voyages almost entirely to the Basse Seine, and did not

venture out to LeHavre. They did quite frequently travel upstream as far as Montereau on the upper Seine, and with the introduction in 1853 and 1854 of seven slightly larger PORTEURS numbered from 6 to 12, direct service was extended to LeHavre. The network was extended much farther still when in 1854 Pieau was given authority to operate a similar service from Paris to Reims, Lille and Valenciennes.⁶⁰ In this first half of the decade Pieau had only one imitator, though there were to be many more in the latter half. These first imitators were the so-called HELICES operated by the Cie LeNormand-Baudu; they were propellor-driven steamers operated between Paris and LeHavre.⁶¹

Prosperity Until the Mid-1850s.

For a few years, as if to compensate for the terrible years of crisis, both railway and bateliers enjoyed considerable prosperity. Performance by the batellerie in particular seemed to justify the optimism expressed in 1850. Although slow, the revival of goods traffic on the Basse Seine was faster than on several other rivers in France.⁶² Although goods traffic on the railway between LeHavre, Rouen and Paris had risen continuously to a high level, the waterway matched its pace of growth and continued to carry an even greater amount of traffic. In both 1852 and 1853 water-borne goods traffic from Rouen to Paris exceeded 300,000 tons; downstream traffic reached almost the same level. Many commodities carried on the river had recovered the levels attained before 1848; little if any traffic however, was regained by the river from the railway. The most remarkable performance was given by cargoes of wines, which in 1852 rose to almost 120,000 tons, the greatest amount ever recorded; in the following year they declined to just under 90,000 tons, still very high. The high level of traffic in 1853 was also partly owing to very much larger than normal cargoes of grain, amounting to almost 20,000 tons. The defenders of the batellerie of course were eager to point out its value in this connection; as they had predicted, the railway proved unable to carry all of the large and unexpected amount of grain required in Paris and at other points along the Seine.⁶³ The early 1850s were the best years ever for the tugboat companies and the bateliers who used them. In 1852 they transported over 198,000 tons from Rouen to

Paris, of which almost 64,000 tons came direct from LeHavre. In 1853 they transported almost 175,000 tons. LeNormand-Baudu, with eight steamers (including two HELICES) and more than thirty-five bateaux and chalands, carried more than a quarter of the total traffic. Next to them in size, as Table 11 shows,⁶⁴ were the tugboat company Delabrousse frères, Poulain, Pottet et Cie (owners of the two tugboats the AIGLES) and the twenty-five or so independent bateliers who regularly used their tugs. Even the bateliers relying upon halage did well in these years, transporting over 90,000 tons upstream in both 1852 and 1853, and downstream reaching almost 220,000 tons, three times the amount pulled by tugboats in that direction. It was no wonder that even in the middle of 1854, when traffic had declined from these high levels, Louis d'Artois described the state of the marine normande as "éminemment prospère".⁶⁵

Table 11

Goods Transport by River from Rouen to Paris, 1853 and 1854.

<u>Company</u>	<u>1853</u>		<u>1854</u>	
	<u>voyages</u>	<u>tonnage</u>	<u>voyages</u>	<u>tonnage</u>
LeNormand-Baudu	273	79,212	175	44,909 *
Muleur et Dally	148	31,340	133	27,517
Delabrousse et Cie	199	73,500	149	51,586
Blanchon	52	16,508	32	8,862
Blanchet	28	9,423	31	9,146
Fleury-Desseaux	60	15,786	22	5,374
Vergught	25	9,047	5	1,700
Brouet	43	8,142	70	9,272
Varnier-Roger	199	13,254	196	16,190
Ch. Pieau et Cie	374	24,520	578	43,966
Leloup-Ruel et Delisle	-	-	10	991
Guibert	-	-	10	454
Festugières	-	-	2	413
Fournier et Lavaux	-	-	12	1,923
Lebarazer	-	-	1	121
Others	112	20,439	138	23,630
TOTALS	1,513	301,172	1,564	245,247

* Includes 8,154 tons carried in 32 voyages by Cardet who took over some of LeNormand-Baudu's equipment after July 1854.

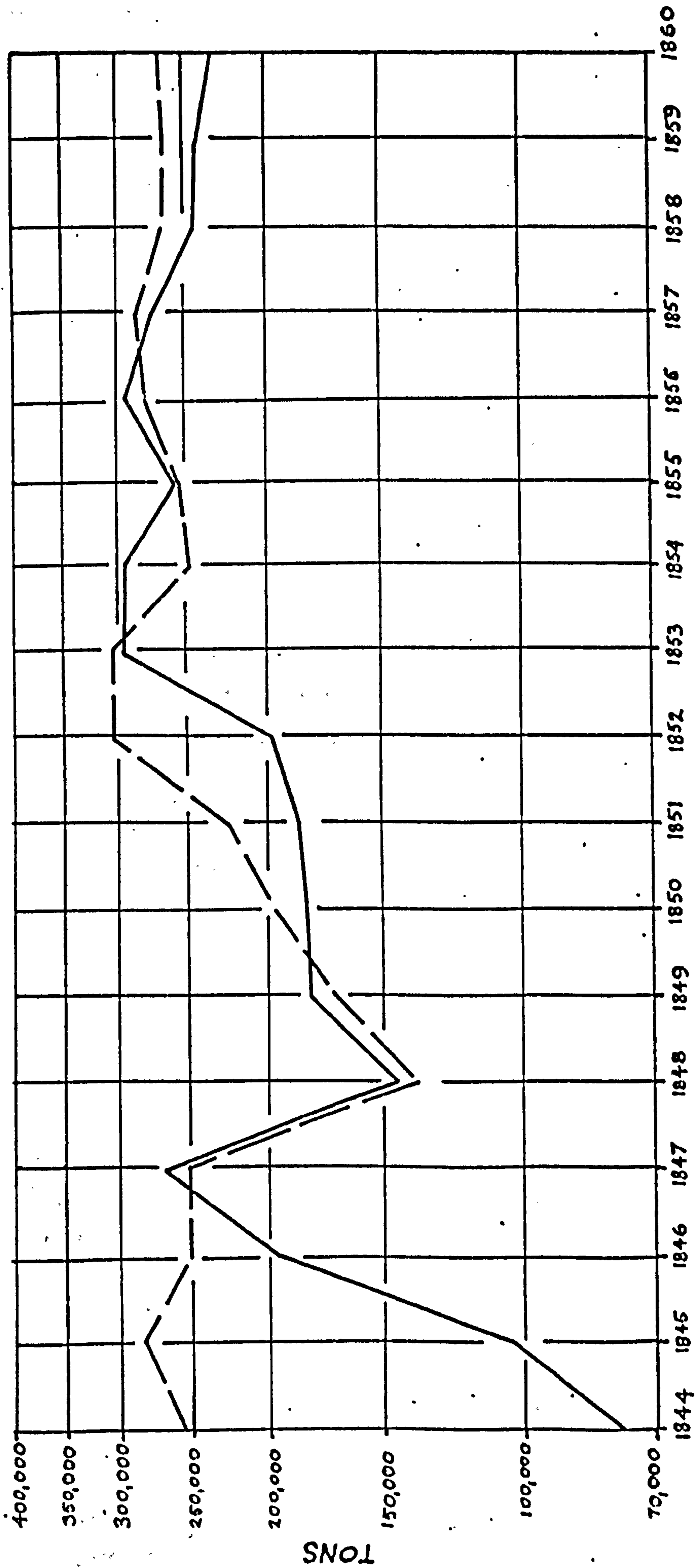


FIGURE 22

GOODS TRANSPORT FROM ROUEN TO PARIS

By River and Railway, 1844 to 1860

RIVER — — —
RAILWAY — — —

Railway goods traffic from Rouen to Paris was less than 200,000 tons in 1852, but it reached over 296,000 tons in 1853. Downstream traffic on the railway amounted to little more than half that carried on the river. Nevertheless, both companies were able to earn substantial profits in the period up to the end of 1854. The average return to shareholders in the Rouen-to-LeHavre company in the five years from 1850 to 1854 was almost five per cent, a full point better than during the previous three years; the highest return was almost 8.5 per cent. For the Paris-to-Rouen the average return was almost nine per cent, almost two per cent higher than in the previous seven years; its highest return until the end of 1854 was 12.8 per cent. After 1854 these two companies were merged with the new Compagnie de l'Ouest, and their individual accounts and financial statements were no longer published.

By 1853 the railway seems to have become the principal carrier of goods travelling directly from LeHavre to Paris. For some time it had carried more of these goods than the batellerie. Railway traffic from LeHavre to Paris amounted to about 180,000 tons in 1853,⁶⁶ compared with 58,000 tons by river. Approximately 211,000 tons of goods were sent from LeHavre only as far as Rouen, and of these water-borne transport had retained a far greater share; it is estimated that the railway carried about 60,000 tons, the batellerie about the same amount, and coasting vessels about 91,000 tons.

Table 12⁶⁷

Goods Transported from LeHavre by River and Rail, 1850-1860.
(metric tons)

	<u>LeHavre to Rouen</u>			<u>LeHavre to Paris</u>	
	<u>Railway</u>	<u>River</u>	<u>Coasting Ships</u>	<u>Railway</u>	<u>River</u>
1850	165,382*	22,322	65,233	- ***	48,173
1851	169,863*	85,545**	84,767	-	-
1852	191,697**	37,867	76,944	-	63,647
1853	240,977**	57,902	91,112	-	57,474
1854	304,308**	36,086	86,234	-	67,060
1855	26,408	39,544	94,237	161,204	74,427
1856	32,259	32,128	109,632	172,732	101,437
1857	22,210	38,803	116,380	135,359	121,812
1858	18,165	54,530	101,902	115,446	84,711
1859	19,433	45,894	96,230	126,057	107,964
1860	28,344	24,709	54,550	134,682	131,692

* Covers period from 1.III.1850 to 28.II.1851, etc.

** Includes traffic from LeHavre to Rouen and LeHavre to Paris

*** Unknown.

In 1853, as Table 13 shows,⁶⁸ there were three companies engaged in water transport on the Seine-Maritime. It was a profitable trade, for the cargoes they carried were almost all of quite high value and earned them good rates. A table of these commodities carried by river transport from LeHavre is given in Appendix III. Many of the less costly goods shipped to Rouen were brought by the coasting trade, and despite the considerable movements of

Table 13

Goods Transport by River Steamers from LeHavre to Rouen,
1853 and 1854

<u>Company</u>	<u>1853</u>		<u>1854</u>	
	<u>voyages</u>	<u>tonnage</u>	<u>voyages</u>	<u>tonnage</u>
LeNormand-Baudu	361	65,533	178	33,598*
Muleur et Dally	233	41,399	441	36,167
Ch. Pieau et Cie	52	5,914	215	23,811
Festugières	-	-	2	793
Guibert	-	-	10	455
Lebarazer	-	-	1	121
Leloup-Ruel et Delisle	-	-	58	6,697
Goulley et Cie	-	-	5	1,499
Others	14	2,530	-	-
TOTALS	660	115,376	910	103,142

* Includes 4,625 tons carried in 21 voyages by Cardet who took over some of LeNormand-Baudu's equipment after July 1854.

goods from LeHavre to Rouen by steamer and by railway, the coasting trade to Rouen remained prosperous. In 1852 goods entering Rouen in coasting vessels amounted to almost 400,000 tons (of which 77,000 tons came from LeHavre); in 1853 this figure dropped by about twenty per cent, but still remained above 300,000 tons (of which over 90,000 tons came from LeHavre). The coasting trade had not grown significantly since the 1830s. Foreign trade was growing quickly, especially into the port of LeHavre. Having fallen to about 350,000 tons (inbound) in 1848, from 600,000 tons in 1847, it rose again to exceed 600,000 tons for the first time in 1853. Outbound tonnage was growing equally quickly and by 1853 exceeded any amount registered in the past. Though foreign

trade into the port of Rouen had not quite regained the level it had reached in the late 1840s, it had nevertheless risen to over 80,000 tons in both 1852 and 1853, almost double the figures for 1848 and 1849.

Changes in the Pattern of Trade and Transport, 1854 to 1860.

The changes which had occurred in the valley of the Seine since the introduction of railways had in one sense not been fundamental ones. The pattern of trade and transport, that is the routes followed by commodities between their origins and destinations, had not changed. Goods continued to flow into the ports of LeHavre and Rouen from both coasting and foreign trade; the railway and waterway simply competed to carry them from there to Paris. Although there had been a strong challenge to the waterway from the railway, and considerable erosion of the former's position, both modes of transport continued to carry large amounts of cargo. In 1854 the trend of growth in goods movements up the Seine was broken and the established system of transport through the ports of Rouen and LeHavre to Paris received the first in a series of shocks which were eventually to bring fundamental changes. The origin of this first shock was the beginning of direct railway transport between the port of Bordeaux and Paris. The effect of this was to short-circuit a large part of the established coasting trade, much of it in wine and spirits, upon which the flow of goods between the ports on the Seine and Paris had for so long depended. In the following year the direct railway line to Marseille was also opened, though this had a smaller impact upon transport along the Seine. The effect of these new railway connections was dramatic, though perhaps in the case of Bordeaux a little exaggerated at first by a poor wine crop in 1854. The fall in traffic to Rouen and LeHavre from the several ports in and near Bordeaux was sixty per cent from 1853 to 1854, and this became 80 per cent by 1855.⁶⁹ Traffic from the Mediterranean, though not as large, was almost equally reduced; from 1854 to 1855, the total amount of goods sent to Rouen and LeHavre fell by 53 per cent. Altogether, between 1853 and 1855 the total coasting trade into LeHavre and Rouen (other than that between them) fell by over thirty per cent, and that into Rouen alone by over 45 per cent. The result was felt in a considerable

fall in the amount of traffic being carried up the Seine. However, owing to constantly rising foreign trade, the fall in river traffic was not so dramatic as the fall in coasting trade. Taking into account carriage by both railway and waterway, the fall in upstream traffic from Rouen to Paris from 1853 to 1855 was twenty per cent; for river transport other than the new services à grande vitesse it was 25 per cent. Rates on the river, moreover, fell again, for the first time going below 9F per ton.⁷⁰

These changes in the pattern of trade and transport had a very adverse effect upon the port of Rouen. They were aggravated by entirely unforeseeable non-economic factors such as extraordinarily low water levels on the Seine in 1858. It was inevitable that Rouen should find itself bypassed by direct rail transport, both between distant ports like Bordeaux and Paris, and as it had been for some time from LeHavre. The same was true of competition from the new bateaux vapeurs à grande vitesse. The reasons were simple; in the words of a study prepared by the Société libre d'émulation du commerce et de l'industrie de la Seine-Inférieure in 1861,⁷¹

pouvait-il en être autrement? Le commerce recherche les voies rapides peut-être plus encore que les voies économiques, les entreprises de chemins de fer lui offrent toutes les facilités désirables; transbordement du navire dans les wagons, séjour en gare, tarifs différentiels....

More than any other port in France, the port of Rouen had suffered from these changes. It was the leading centre of the coasting trade, and it depended to a very large degree upon the trade in wines and spirits and in goods from the Midi. Formerly, in the words once again of the Société libre d'émulation,

les caves de Dieppedalle n'étaient pas assez vastes pour contenir tous les liquides consignés à Rouen, de nombreux commissionnaires de transit étaient occupés à recevoir, soigner, expédier les marchandises.... mais tout cela est changé. Rouen n'est plus l'entrepôt de Paris; les vins, les esprits, les marchandises du Midi prennent les voies ferrées, les caves de Dieppedalle restent vides, nous n'avons plus de transit.

The situation was not hopeless however, as the Société libre pointed out. Rouen's foreign trade was growing, and if it could be given adequate facilities, both technical and commercial, this could be made to replace the declining coasting trade. The improvements being made to the Seine Maritime had already gone some way to encouraging this.

The adverse impact upon the marine normande, which had always depended primarily upon trans-shipment of foreign and coasting trade at Rouen, was severe. After surviving the onslaught of competition from the railway for more than a decade, it began in the later 1850s permanently to decline. With rapid transport by rail, and to an increasing extent by high-speed steamers, these slower vessels had difficulty competing. The old bateaux halés, despite improvements to the river, were still taking four to five days from Rouen to Paris, while tug-pulled chalands took sixty hours or more. The railway could transport goods over this route for delivery in Paris within 48 hours; the PORTEURS could do it in only thirty. As the railways were extended, the waterways became increasingly handicapped; the railway, remarked Louis d'Artois in the Moniteur de la Marine,⁷² were "mieux servis, dans leurs opérations, par le mauvais état des voies navigables, que par la puissance même de leurs moyens et par leur union." Added to this in the late fifties was an extended period of low water levels in the Seine, levels lower in fact than had ever before been recorded.⁷³ The bateliers were able to carry much less than full loads, and were forced for long periods, in 1858 to sit idle waiting for sufficient water depth to proceed upstream through the canal St.-Denis. Further delays were caused by damage and premature decay of the locks at Andrésy. The goods transported upstream by bateaux halés fell from almost 100,000 tons in 1853 to less than a third of that by 1860. Traffic carried in tug-pulled chalands, which for more than a decade had been the dominant means of water-borne transport on the Seine, fell from almost 200,000 tons in the early 1850s to about 120,000 tons in 1860. In the carriage of downstream cargoes, always much less remunerative than those upstream, they maintained better traffic for a few years, but even these had suffered considerably by 1860. Rates of carriage were forced down to less than 8F per ton upstream by 1860, and the state of the batellerie was described then as "vraiment affligeante".⁷⁴ Petitioning the Minister in 1858 for further improvements to the river channel, reduction of the droits de navigation and other charges, and prohibition of the tarifs d'abonnement, the mariniers complained even of trouble in recruiting crews for their boats.⁷⁵

Déjà ce personnel diminue, et nous avons beaucoup de peine à le recruter dans les familles où on était marinier de père en fils, mais qui sont aujourd'hui trop découragées par l'état d'une

industrie si profondément atteinte, par l'incertitude de l'avenir et par les difficultés présentes à ne pas chercher à se créer d'autres ressources.

It is evident that the batellerie was suffering from steady attrition in the number of vessels in service. The number of bateaux normands fell from what had been well over 150 before 1848 to less than a third of that in 1860. The number of chalands in service fell from a high point of over fifty in 1853 to only about thirty in 1860.⁷⁶

The railway was not excluded from this change in the pattern of trade and transport. Owing to the almost total lack of statistics on the commodities carried by the railway, it is difficult to determine to what extent it was dependent upon movement of goods by the coasting trade for its own traffic. The only statistics available, those for 1854, are very little help; not only do they show only the total of traffic flows in both directions, as can be seen in Table 14,⁷⁷ but the breakdown into commodities is very much lacking in detail. Total traffic flows between all the important origin and destination points are available only from 1855,⁷⁸ and give very little guidance therefore in assessing changes from before that time. For 1855 these show much more traffic destined for Paris originating in LeHavre (161,204 tons) than in Rouen (69,141 tons); given the balance between overseas and coasting trade in these ports, it would appear that the railway was carrying predominantly goods from the former. What little evidence exists suggests this had also been the case in 1853 and before. Nevertheless, judging from the figures given in Table 14, a considerable volume of the railway's traffic did come from the coasting trade; cereals, grain, flour, wines and spirits, and a considerable proportion of the construction materials came from other ports in France and not from abroad. Diversion of this trade to other railway lines directly connecting ports such as Bordeaux with Paris was therefore a serious threat to the railway companies' continued financial health. Several steps taken by the railways in these years can be explained by a desire on their part to minimize this diversion and its adverse effects upon their profits.

The first step was designed both to reduce the competition for goods along the Seine and to decrease the diversion of coasting and foreign trade to other railways. There had been rumours

Table 14

Goods Carried by the Three Seine Valley Railways:
Traffic in both directions, 1854. (tons)

<u>Commodities</u>	<u>Rouen-Paris</u>	<u>LeHavre-Rouen</u>	<u>Dieppe-Rouen</u>
Céréales, graines, légumes secs	41,416	42,716	2,838
Farines	21,038	23,439	2,267
Vins, vinaigres, esprits	27,625	16,826	5,048
Huiles	11,428	9,638	1,408
Denrées alimentaires	12,539	14,558	5,689
Sucre brut et raffiné	9,981	10,074	668
Denrées coloniales	14,779	15,894	267
Cotons et laines en balles	35,478	54,995	1,857
Fils, tissus et divers	12,829	9,664	1,233
Fonte, fer et métaux	45,072	25,524	1,959
Quincaillerie, verrerie	3,644	3,742	431
Bois de chauffage, charbon de bois	208	3,137	836
Matériaux de construction, bois, pierres, briques	21,788	26,800	12,574
Pierre à plâtre et à chaux, plâtre, chaux	12,070	14,951	5,466
Engrais et amendements div.	4,854	4,935	36
Houille	4,331	45,153	30,158
Coke	1,430	174	11
Autres marchandises	169,144	126,344	16,106
TOTAUX	449,654	448,564	88,882

on several occasions in the early fifties of agreements between the railway companies and elements of the batellerie. It will be recalled that a similar agreement had failed to materialize in the previous decade. In 1854, just as the Seine railways were about to merge with others in Normandy and Brittany, they finally reached agreement with the most important company among the marine normande. In exchange for a sum reported by the Moniteur de la Marine to be 1,080,000F the Cie LeNormand-Baudu sold its entire fleet of tugboats and chalands to the railway.⁷⁹ Though for a time some of this fleet was leased back to LeNormand-Baudu's former

agent in LeHavre, Cardet, its activities were greatly diminished (as is evident in Tables 11 and 13), and the railway is said to have obtained a share of the revenue it earned.⁸⁰ What was intended to be an equally important part of the agreement with LeNormand-Baudu involved the establishment over the next ten years of a new fleet of steam-propelled coasting vessels designed to connect the railway at LeHavre with ports in France, on the North Sea and in the Mediterranean. LeNormand-Baudu is said to have agreed to use three-quarters of the price paid to him for this purpose. Unfortunately for the railway, this part of the agreement does not seem to have been very successful. The first of the new steamers, the MEDITERRANEE, sank on its first voyage in 1854,⁸¹ and of two others launched in 1856, the SEINE and the ISLY, the latter was compelled to convert from steam to sails late in 1857.⁸² In the rest of the decade, there is no evidence of any other ships being operated by LeNormand-Baudu.

In 1855 the three railways in the Seine valley finally reached agreement to merge with the Paris-to-Cherbourg and the small Cie de l'Ouest which had been formed in 1851, to form the new large Cie des Chemins de fer de l'Ouest. Negotiations for this merger had been going on for several years,⁸³ and it put within the control of a single company all the ports along the coast from Dieppe to Brest, though this was slight compensation for loss of a share in the coasting trade from Bordeaux. Compared with arrivals from the region of Bordeaux and the Charente of almost 114,000 tons in 1853, those from the ports north of Granville were less than 40,000 tons. An attempt to extend this influence toward Nantes and the Breton ports was thwarted when permission was denied to the Cie de l'Ouest to build a branch line from LeMans to tap the traffic of the Paris-to-Nantes at Angers.

Beginning in 1854 there was a strong revival of local opposition to the methods of competition used by the railways. The changing structure of trade and transport begun in the mid-1850s, and tighter competition between railway lines and ports which accompanied it were quickly felt by all the established centres of trade. Declining use of ports and the coasting trade, declining water-borne traffic, more direct and inter-line railway transport which by-passed traditional entrepôt towns and cities

like Rouen, Lyon, Strasbourg, and even Paris, sharpened general awareness of the competitive methods being used by the railways. The Chambre of Commerce in Rouen protested to the Minister immediately it discovered the agreement between LeNormand-Baudu and the railway companies; the Chambre of Commerce in LeHavre also protested, though they were largely appeased by explanations from the companies that one of the purposes of the agreement was to divert more of the coasting trade away from Rouen and into LeHavre.⁸⁴ Rouen's demand that the Administration disallow the takeover of LeNormand-Baudu, as it had a similar one on the Rhône in the previous year,⁸⁵ met with no result. Rouen's response to this development was not unexpected, wrote an editorialist in the Journal des Chemins de Fer; it had never approved any of the companies' actions. "A l'exemple des doges de Vénise", he wrote, "elle a épousé la fleuve".⁸⁶

The question of price discrimination was also actively revived, with the Chambre of Commerce in Rouen taking a leading part. Early in 1854 the Chambre of Commerce in Strasbourg canvassed its counterparts in other cities for support in opposition to the recently introduced 'tarif international' of the Cie de l'Est, which it said was forcing it out of its accustomed role in the transit trade with Germany and Switzerland. Rouen willingly gave its support.⁸⁷ LeHavre did not; it needed them to compete with its rival in this trade, the port of Antwerp.⁸⁸ With the opening of the second section of the Ceinture in March 1854, goods in transit through LeHavre rose by more than 85 per cent over 1853;⁸⁹ nevertheless they remained barely a third of the transit traffic through Antwerp.⁹⁰ Letters opposing tarifs différentiels and tarifs de faveur were sent by the Chambre of Commerce in Rouen to the Minister of Commerce and Public Works at the end of 1854 and again late in 1855; on the second occasion they received the cautious support even of their rivals in LeHavre.⁹¹ Further petitions both to the Minister and to the Senate early in 1856, protesting once again the takeover of LeNormand-Baudu and the continued use of price discrimination met only with polite acknowledgements.⁹² With no results from this line of attack, the railways' opponents shifted their attention to the courts. Encouraged by a judgement in the Tribunal du commerce de Rouen in 1855 which if allowed to stand would have destroyed the system of

tarifs de faveur,⁹³ the Chambre of Commerce decided to support the plaintiff when the case was appealed first to the Cour Imperiale in Rouen and later to the Cour d'Appel in Paris. To their chagrin however, the decisions on both appeals went against them.⁹⁴

In the meantime, in face of this opposition to their tarifs de faveur, several railway companies, including the new Cie de l'Ouest decided to abandon them in favour of a new arrangement, the so-called tarifs d'abonnement. Under these the discounts formerly offered only to a few individuals with large quantities to ship (the tarifs de faveur) were extended to all on condition only that they undertake to send all of their goods exclusively by rail. These new tariffs came into effect in 1856,⁹⁵ but fearing that they also would provoke a hostile response, the Minister gave them only provisional approval. After a few months of trial he went farther still by asking the Chambres of Commerce for their opinion on the merits of the new tarifs d'abonnement; "Y a-t-il lieu d'admettre", he asked,⁹⁶

comme condition des tarifs reduits, un engagement, pris par l'expéditeur de confier pour un temps déterminé au chemin de fer, à l'exclusion de toutes les autres voies de transport, toutes les marchandises soumises au tarif général?

To this 44 out of 49 respondants replied 'no'. Following rumours that another agreement had been made between elements of the marine normande and the railway, the Chambre of Commerce in Rouen took advantage of a visit by the Emperor to their city to make their opposition to tarifs différentiels and de faveur known at the highest level of government.⁹⁷ Though one may doubt any connection between events, within a month the Minister of Public Works issued a circular stating that all tarifs de faveur were to cease at the end of 1857,⁹⁸ and also called an official inquiry by the Comité consultative des chemins de fer into the new tarifs d'abonnement.⁹⁹ Opposition both from the Chambres of Commerce, the Syndicat de la Marine and from the general public had evidently made itself felt, for on January 25th 1860 an arrêté ministérielle declared all tarifs d'abonnement to be illegal.¹⁰⁰

The Success of Innovations in Water Transport. While the older means of water-borne transport suffered from the loss of a large proportion of their traditional cargo, the newer bateaux vapeur à grande vitesse continued to increase their traffic.

Had these new vessels not been in operation at this time, it is likely that water-borne transport would have fallen far behind the railway in its share of the total traffic. In the event the new fast steamers were able to prevent this. There is no doubt that the key to their success was their speed. In 1856 an official report to the Prefect of the Seine-Inférieure¹⁰¹ remarked on the

excellente organisation du service accéléré des bateaux Porteurs qui rend à domicile, en moins de temps que le chemin de fer, les marchandises qui lui sont confiées à Rouen et au Havre pour Paris....

Despite higher rates than those on the railway they were able to capture an increasing share of the total traffic on the Seine. The cargoes they were especially well suited to carrying were costly imported commodities and manufactures. Since many of these goods were carried directly from abroad to the port of LeHavre, they were not being diverted to other inland transport routes, as many of the goods in the coasting trade were. It was these goods which in the words of a contemporary required "exactitude, régularité et rapidité". Most important among the goods they carried in increasing quantities were raw materials like vegetable oils, certain chemicals, copper, dye woods, hides and raw cotton, tropical products like coffee and sugar, and manufactures like cotton textiles. The total traffic in these few types of goods amounted to almost 83,000 tons from Rouen to Paris in 1860. They were over 70 per cent of the total carried by the services de grande vitesse.

The traffic carried by them, as can be seen in Table 15,¹⁰² grew rapidly and continuously from small beginnings in 1851. In 1853 there were still only two companies engaged in the business. Pieau et Cie carried about five-sixths of the traffic, and Le-Normand-Baudu et Cie carried the remainder. In the next year the goods carried from Rouen to Paris doubled in quantity, despite takeover of LeNormand-Baudu by the railway. Eleven more vessels were added to the 'fleet' in 1855 and 1856, and in the latter year traffic more than doubled again. By the end of the decade, the services de grande vitesse were carrying more than two-fifths of the total water-borne goods traffic from Rouen to Paris. They seem to have made similar progress on the Seine-Maritime. Much of their traffic was carried directly from LeHavre to Paris, and by late in the 1850s water-borne transport was very closely rival-

ling the railway in this field. The PORTEURS of Picau et Cie gave door-to-door service from LeHavre in less time than the railway; other new steamers like the ten EXPRESS of the Cie Leloup-Ruel et Delisle and the four COURRIERS DE LA SEINE of LeNormands Fils, though not as fast as the PORTEURS, offered regular service and at rates very little above those of the chalands. The services de grande vitesse also carried increasing amounts of goods to destinations on the lower Oise, the Aisne and in the north of France. The two SERVICES DE L'OISE put into service in 1856 and 1857 by Gilles Cardin were reserved for this traffic. In 1860 about 68,000 tons of goods (excluding coal were transported by water between Rouen and various points on the Oise, Aisne and the waterways of the north.

Table 15

Goods Carried from Rouen to Paris, 1846 to 1860

		(metric tons)		
	<u>grande vitesse.</u>	<u>chalands remorqués</u>	<u>bateaux halés</u>	<u>railway</u>
1846	-*	75,605	170,253	195,815
1847	-	107,853	140,746	268,302
1848	-	106,404	22,649	141,083
1849	-	117,049	49,123	177,779
1850	-	118,570	78,927	180,287
1851	1,285	165,632	60,133	184,264
1852	11,967	198,096	91,502	199,298
1853	30,391	172,586	98,193	296,291
1854	55,332	154,694	35,221	293,766
1855	50,634	151,857	52,555	255,955
1856	103,430	131,496	40,759	292,074
1857	93,043	150,962	39,292	272,576
1858	87,343	125,541	52,780	244,543
1859	103,372	131,751	30,204	243,694
1860	115,817	122,950	30,093	231,332

* None.

Between 1852 and 1860 more than fifty new steamers were commissioned for operation on the Seine. The Cie Picau had not for long been alone in the field with its new steamers. During the decade following 1851 fifteen other new companies were formed

Table 16

'Bateaux à vapeur à grande vitesse', 1851-1860

<u>Name of Ship</u>	<u>Owner</u>	<u>Date of Commissioning</u>	<u>Service</u>
PORTEUR	Cie Pieau	1851	Rouen-Paris
PORTEURS 2,3,4,5	"	1852	"
PORTEURS 6,7,9,10	"	1853	LeHavre-Paris
PORTEURS 8,11,12	"	1854	"
VILLE DE SOISSONS	Georges & Cie	1852	Rouen-Paris
HELICE NO. 1,2	LeNormand-Baudu	1853	"
HELICE 3,4,5	Cardet Aîné	1856	LeHavre-Paris
EXPRESS	Cie Leloup-Ruel, Delisle	1855	"
EXPRESS 2,3,4,5	"	1856	"
EXPRESS 6,7,8,9,10	"	1857	"
ANNA	Cie Masson	1855	Rouen-Soissons
SERVICE DE L'OISE 1.	Cardin	1855	Rouen-Soissons
GLANEUR	Boivin & Cazanave	1855	Rouen-Port Audemer
HERCULE	Fournier & Lavaux	1854	Rouen-Paris
MARECHAL BOSQUET	Vaghi & Cie	1856	LeHavre-Paris
SERVICE DE L'OISE 2.	Cardin	1857	Rouen-Soissons
DU TREMBLAY	Vaghi & Cie	1856	LeHavre-Paris
VILLE DU HAVRE	"	1857	"
VILLE DE PARIS	"	1857	"
GRAVILLE	Bertin & Cie	1857	"
PORTEURS 13,14,15	Larget & Cie	1858	Rouen-Creil
ROUENNAIS	Bertin & Cie	1858	"
LE VAILLANT	Vaghi & Cie	1858	LeHavre-Rouen
COURRIER DE LA SEINE	LeNormand fils	1858	Rouen-Paris
COURRIER DE LA SEINE 2,3,4	"	1859	LeHavre-Paris
ST.-OUEEN	Bertin & Cie	1858	"
PORTEURS 28,29	Pieau & Cie	1859	Caen-Paris
PORTEURS 26,30	"	1860	LeHavre-Paris
HONFLEURAIS	Lacoudrais & Cie	1854	Honfleur-Paris
LAROMIGUIERE	Festugières & Cie	1854	Bordeaux-Paris
PARIS-ET-LONDRES 1,2,3	Armand & Guibert	1854	London-Paris
PAQUEBOT DE LA SEINE 1-4	Jouvellier & Cie	1857	Rouen-Creil
VILLE D'AMIENS	Larget & Cie	1860	"
VILLE DE SEDAN	Morianne	1860	Rouen-Reims
SEINE-ET-TAMISE	Gaudet Frères	1858	London-Paris

to operate services de grande vitesse. Table 16 shows an outline of this remarkable development.¹⁰³ The first other company to follow Pieau's example was LeNormand-Baudu, an established operator. In 1854 Cardet aîné, who had been an agent of LeNormand-Baudu, took over some of the latter's steamers, including two HELICES and two of its four other older ones; two years later three more HELICES, also built by LeNormand-Baudu in Rouen, were added to Cardet's small fleet.¹⁰⁴ After Pieau, one of the most important of the new companies to appear was the Cie des Bateaux express de la Seine, formed in 1854 also by two former agents of LeNormand-Baudu, C.-A. Leloup-Ruel of LeHavre and A.-J. Delisle of Paris.¹⁰⁵ Between 1855 and 1857 they commissioned ten new steamers named EXPRESS, operating as both goods carriers and as tugboats between LeHavre and Paris. They also acquired twenty or so chalands, among them a dozen new ones. In 1853 the son of Louis Bertin formed a new company at LeHavre, the Compagnie Général des paquebots de la Basse Seine.¹⁰⁶ Its object was to carry both goods and passengers from Paris to LeHavre; passenger service began late in 1854, but does not seem to have lasted beyond 1856.¹⁰⁷ In 1856 Bertin formed a second company called the Union du Commerce, Compagnie de Transport par Eau,¹⁰⁸ and in the following two years put into service three new steamers. Other companies formed during this decade were the important Cie Larget, formed in 1858 to operate four new steamers largely between Rouen, Paris and Creil (on the Oise); LeNormand fils; and the Cie Cardin fils, successor to a very long-established family enterprise serving the Seine and the Oise.

This remarkable development of services de grande vitesse was extended into the foreign coasting trade. Several fast steamers were commissioned to connect Paris with Caen, Bordeaux, London and the Mediterranean. Evidence of these developments can be seen in Tables 11 and 16 above. In 1857 a new and very ambitious company was announced,¹⁰⁹ the Compagnie française de Navigation à vapeur, de roulage et des messageries, with a capital of 20 MF. Its organizers planned that its vessels would connect Paris directly with a large number of French and foreign ports, including several in Italy and in the colony of Algeria. Operations began in April 1857 with services between Paris and LeHavre.

The company lasted for only a very short time; in February 1858 it was forced to declare bankruptcy, and its directeur was sent to prison for an infraction of the new law on companies. The company's operations in the Mediterranean seem to have been halted by a new common tariff for textiles agreed to by the Cie de l'Ouest and the Cie Paris-Lyon-Marseille.¹¹⁰ Other less ambitious and better founded companies however, were able to continue and expand operations, especially to Great Britain, during the 1860s.

Attempts to establish new bateaux vapeur à grande vitesse in the domestic coasting trade were less successful. As the railways had done after purchasing the equipment of LeNormand-Baudu, Pieau and others also tried to obtain a greater share of the domestic coasting trade by establishing connecting services out of Rouen and LeHavre. Twenty-three such steamers were put into service in the four years from 1854 to 1857, the most important of them being the ten PORTEURS MARITIMES owned by Pieau and several others built for LeNormand-Baudu. However, these ships also found it difficult to compete with the new interior lines of transport being established by the railways. In January 1859 the Cie de l'Ouest and the Cie Paris-Orléans were given permission to use a new common tariff for wines and spirits between Bordeaux and the Charente and ports on the Normandy coast, including Rouen; the reductions in the price of railway transport were as much as sixty per cent. Pieau was forced following this to reduce his fleet of coasting steamers from ten to only three.¹¹¹

* * *

The last years of this decade were the end of what might be called the first phase in the development of a system of mechanized transport in the lower Seine valley. Horse-drawn intercity road transport had been almost entirely eliminated. Horse-drawn river transport from Rouen to Paris had been reduced to only ten per cent of the total. Steam-propelled tugboats had been operating for more than thirty years, and a new generation of fast steamers for almost a decade. A railway had been established for almost twenty years. Finally, the first phase of improvements to both the Seine-Maritime and the Basse Seine was completed at about this time. A new era of competition had

just begun, as more railways were built to join Paris with every important point in the interior and on the coasts; railway company mergers served to intensify inter-line rivalries.

During the 1850s a third stage of innovation in river transport began, and by the mid-1860s it had taken over a large proportion of water-borne transport. This was the system of touage à chaîne noyée. During the 1820s two experts on steam navigation, Tourasse and Mellet, had attempted to pull chalandes with so-called toueurs;¹¹² these were vessels propelled not by means of paddles or propellers, but by means of a chain laid in the bed of the river along which the vessel was pulled by its own steam-powered capstan. In theory the system should have been very efficient; Tourasse estimated that by applying power directly to a chain rather than through paddles to water, the same engine could be made to pull about six times the weight. A vessel using this new principle was operated experimentally on the Basse Seine between 1821 and 1826. However, there were several technical problems which could not be solved, and the idea had to be abandoned. Some years later the invention of Tourasse and Mellet was revived, and for several years a system of touage seems to have been operated successfully on the Seine close to Paris. Then in March 1853 three separate applications were made to the Minister of Public Works for permission to establish a service de touage à chaîne noyée on the Seine between Paris and LeHavre.¹¹³ In the public inquiry which was subsequently ordered by the Minister, there were many who expressed fears that any company given exclusive privileges to operate such a service would quickly become a monopoly. The commission of inquiry at Rouen rejected the idea for this reason.¹¹⁴ Despite these objections however, a concession was given in 1854 to one of the three applicants, Godeaux fils et Cie., to operate a service between Paris and Rouen.¹¹⁵ By 1857 it was operational between the mouth of the Oise at Conflans and Paris, and remorquage between these two points was very greatly reduced. By 1860 however, touage had made little difference to operations between Rouen and Paris.

During the 1860s the new system of touage was extended to cover the whole of the Basse Seine and the Seine-Maritime. Godeaux began operating to Rouen in 1863 with three toueurs, and by 1867 there were six.¹¹⁶ In 1860 he applied and was given authority

to extend the system to LeHavre¹¹⁷ and within four years there were two toueurs in operation on the Seine-Maritime.¹¹⁸ Their efficiency in pulling large loads easily bore out the early hopes of Tourasse and Mellet. Beginning in the 1860s, touage took over a major proportion of the water-borne goods traffic on the Seine and on several other important waterways in France; its domination was to last until the end of the century. Even by 1867 there was only one tugboat being used on the Basse Seine; in 1860 there had been five. On the Seine-Maritime tugs were not so dispensible, and by 1867 ten of them were still in operation there. Though touage was somewhat faster than remorquage, for several decades it could not replace the services de grande vitesse. The fast steamers continued therefore to operate on the Seine for some time, and as the river was progressively improved and deepened, they increased in size. By the 1870s PORTEURS of over 200 tons were being used on the Basse Seine.¹¹⁹

CONCLUSION

It should now be possible to describe more generally the process of innovation and change in the transport system which occurred in the lower Seine valley. Louis Girard identifies two stages in the process of change. In the first, he says,¹ "each new kind of transport is conceived as a way of complementing the particular method prevailing at the time." In the second, "the new method of transport attains its typical form and develops its own capacities to the full.... (It) seeks to become predominant by asserting its complete independence." The motive force for change which gives this process its character is the small innovation, at first integral to the existing system of transport, but improving it in some way. The events described in the nine chapters above tend to confirm the pattern suggested by Girard. Successful attempts to change the transport system on the lower Seine started with modest innovations designed to solve specific technical problems or to overcome particular physical obstacles; they also met the peculiar economic needs of the local economy. When first introduced, these innovations were conceived by users of the system, and usually by the innovators as well, simply as improvements to the existing transport system. Gradually they were extended over the whole existing system, some of them eventually displacing it. Attempts to displace the existing system with complete and independent new systems failed. Remorquage and navigation accéléré, for example, succeeded; the first steamers, which would have displaced many of the existing vessels on the lower Seine, did not. The short line of railway through the Seine valley from Rouen to Paris succeeded; the larger scheme for an independent railway across the plateau from Paris to the sea did not. The simple invention of Poirée succeeded; the ambitious scheme to displace river navigation by a maritime canal did not.

The pattern of success and failure evident in these few examples suggests, at least in the case of the lower Seine, an additional element in the process outlined by Girard. The question must be asked, why did the several attempts to innovate on a large scale fail? It is clear that from the early 1820s there was a fairly widespread desire for improvement in the transport system. Shippers wanted faster, cheaper transport, and they looked principally to Great Britain for an example of what could be done to provide it. The changes which came about over the next few decades were to a considerable extent the outcome of this original desire for improvement. There were techniques available which at several points between 1820 and 1860 could have been used to bring about rapid and radical change in the transport system. Why when both the desire for change and the technical means to bring it about existed, was change such a very slow process? It is clear that resistance of various kinds stood between the desire for change and its realization. While this may appear a rather commonplace statement, it may be useful to view the process of change in part as a gradual defeat and accommodation of the resistance to it. Certainly in the case of the lower Seine, the process of change we have witnessed acquired its character as much from the nature and the sources of this resistance as from the innovations which gradually overcame it. In the lower Seine valley, where there was a long and well-established existing transport system, resistance to change was likely to be considerable.

Corresponding approximately with the two stages suggested by Girard, there seem to have been two stages of resistance to change. In the first there was resistance to large innovations which sought to displace the existing system. Resistance could of course be deliberate, and came from the many people involved in the existing system, who were naturally opposed to anything which threatened their settled livelihood. These people were assisted to a very large degree during this first stage by resistance of another kind, which came from the technical, economic and political environments in which innovation took place. During this first stage smaller innovations seen as complementary to the existing system were generally welcomed for the improvements they brought. At the same time, attempts to

displace the existing system were resisted.

The earliest example of successful innovation was remorquage. It was welcomed for the assistance it brought in avoiding the barre and in increasing the speed of transport. The maritime canal on the other hand met with deliberate resistance in Rouen and LeHavre, neither of which had any important part in the new system it would have created. More effective in preventing approval and construction of the canal was the inability of its designers to devise an economical means for crossing the river at several points. The Conseil-général des Ponts et Chaussées, not wishing to create a monopoly for the canal, insisted that it not interfere with river-borne navigation. Within the existing state of technique this requirement could not be satisfied economically. A few years later, the shorter line of railway through the valley from Rouen to Paris was at first quite readily and widely accepted. It was not thought during most of the 1830s that railways would compete for many of the goods then carried by inland water-borne transport. By going as far as Rouen, this railway would not disturb the existing pattern of transport in which Rouen was the head of ocean navigation. Moreover, it would serve both transport between Rouen and Paris, and also the needs of the many small towns in the valley between. In contrast to this, the railway which it was proposed to build across the plateau would have been independent of the existing transport system. Since it would depend principally upon transport between LeHavre and Paris and beyond, and would by-pass the principal centres of population in the valley, its probable revenues were smaller. This and its much greater expected construction cost combined to make financing the project very difficult. Only a smaller project within the confines of the present transport system and population distribution could be economic and financially viable. The plateau route was forced to seek substantial aid from the State, and in doing so it became embroiled in the general debate over railways. This served as another obstacle to its success.

The second stage of resistance began when it became evident that the innovations which had been successful during the first stage were extending themselves beyond their original

limited roles, and were threatening to become independent and displace the existing system. What occurred was a reaction against this threat, and during this stage the resistance to change became much more deliberate. Even in the 1820s the Chambre of Commerce in Rouen saw that remorquage and chalandage were beginning to become independent of the traditional system, avoiding as they could any trans-shipment in Rouen. The Chambre reacted by attempting to ensure with their own tugboats that coasting vessels would continue to come up to Rouen. The reaction to the railway was much stronger. By 1846 it hardly needed Victor Grandin, the vocal deputy from Elbeuf, to point out that railways were not simply "le complément et le perfectionnement des autres voies de transport." During the following years there were several factors which resisted the railway companies and prevented them from achieving their principal objective, "celui d'absorber à (leur) profit la totalité des transports, voyageurs et marchandises." The first was the restraint upon the companies' use of their tariff as a competitive weapon; this was used by the Administration specifically to protect the existing system of transport. The State was also involved in attempting to improve the river and thereby enable the existing system to compete and survive. As we have seen the operators of the existing system themselves came together to protect their interests and succeeded for example in preventing the railway from establishing its own independent entrepôt in LeHavre. By grouping together, the use of tugboats was greatly extended to increase the speed of navigation. The most successful response to the threat from the railway was the introduction of bateaux vapeur à grande vitesse. Taken together these responses prevented the railway within the period up to 1860, from becoming entirely independent and displacing water-borne transport. The railway and other important innovations had undoubtedly made great progress, but resistance to their innovations had made the process of change a very slow one. It also ensured that whatever the change, the modified system would always contain elements of the old.

1. The first part of the report is a summary of the work done during the year.

2. The second part is a detailed account of the work done during the year.

3. The third part is a summary of the work done during the year.

4. The fourth part is a summary of the work done during the year.

5. The fifth part is a summary of the work done during the year.

6. The sixth part is a summary of the work done during the year.

7. The seventh part is a summary of the work done during the year.

8. The eighth part is a summary of the work done during the year.

9. The ninth part is a summary of the work done during the year.

10. The tenth part is a summary of the work done during the year.

11. The eleventh part is a summary of the work done during the year.

12. The twelfth part is a summary of the work done during the year.

13. The thirteenth part is a summary of the work done during the year.

14. The fourteenth part is a summary of the work done during the year.

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APPENDIX I

Seaborne Shipping in the Port of RouenA. Sources

Statistics on both foreign and coasting trade into and out of Rouen are printed continuously from 1825 to 1860, and beyond, in:

Direction général des Douanes. Tableau général du Commerce de la France. (Paris 1818 ...)

Beginning in 1850 a separate volume was published for the coasting trade:

Direction général des Douanes. Tableau général du mouvement de cabotage. (Paris 1850 ...)

These volumes contain a large quantity of other material in great detail, including numbers of ships registered in all important ports (by tonnage classes); a breakdown by countries of origin and destination of foreign and colonial trade (from 1841); a breakdown by ports of origin and destination of the coasting trade (from 1837); tonnage of particular commodities shipped in and out in foreign trade (from 1857); tonnage of particular commodities shipped in and out in coasting trade (from 1838); a breakdown by customs ports of entry of 'transit' trade (from 1832); a breakdown by entrepôts of 'mutations d'entrepôt'.

Many of the same statistics for Rouen, in addition to some others (concerned principally with exports of textile manufactures) are contained in the following publication, available in the Bibliothèque municipale de Rouen:

Chambre de commerce de Rouen. Statistiques de Commerce maritime du port de Rouen de l'année 1843 à 1867. (Rouen 1844-1868).

A detailed breakdown of foreign trade in the Port of Rouen by countries and by commodities exists in manuscript in:

Archives départementales de la Seine-Maritime. Series M. Statistiques: commerce, industrie, enquêtes, (1830-1837). "Douanes. Direction de Rouen. Bureau de Rouen. Etat des principales Marchandises exportées (et importées) pendant le 1er Séestre 1833...."

Manuscript records of individual ships arriving and departing the port of Rouen for the years 1830, 1837, 1838, 1846, 1848 and 1855 are contained in separate bundles in:

Archives départementales de la Seine-Maritime. Series M. Mouvement des Ports.

B. Shipping to and from Foreign and Colonial Ports

(Total Net Registered Metric Tonnage of ships,
excluding ships in ballast)

<u>Year</u>	<u>Arrivals</u>	<u>Departures</u>	<u>Year</u>	<u>Arrivals</u>	<u>Departures</u>
1825	20,717	7,750	1843	111,653	9,216
1826	16,662	6,631	1844	77,835	13,987
1827	14,394	5,233	1845	110,140	22,368
1828	21,545	6,830	1846	121,511	23,243
1829	37,282	6,082	1847	102,927	24,027
1830	21,315	7,155	1848	46,502	29,444
1831	7,280	3,350	1849	43,640	34,105
1832	22,117	7,185	1850	61,272	44,442
1833	18,185	5,524	1851	71,112	45,971
1834	17,013	5,844	1852	84,884	44,620
1835	27,892	5,897	1853	81,475	46,903
1836	45,514	6,457	1854	69,875	36,426
1837	37,402	7,249	1855	110,082	39,231
1838	65,509	6,236	1856	136,367	46,624
1839	59,313	5,892	1857	120,496	57,101
1840	74,410	7,924	1858	127,386	79,350
1841	79,096	9,241	1859	118,780	66,025
1842	107,651	12,686	1860	120,377	48,662

C. Shipping to and from other Ports in France

(Total Net Registered Metric Tonnage of ships,
excluding ships in ballast)

<u>Year</u>	<u>Arrivals</u>	<u>Departures</u>	<u>Year</u>	<u>Arrivals</u>	<u>Departures</u>
1825	173,983	174,891	1843	306,019	173,598
1826	167,514	185,780	1844	260,378	159,719
1827	141,470	148,979	1845	291,080	158,768
1828	157,336	162,344	1846	334,516	156,909
1829	159,181	174,837	1847	253,203	146,239
1830	183,048	182,361	1848	154,359	94,231
1831	105,231	109,874	1849	191,879	104,400
1832	118,619	114,611	1850	192,647	123,089
1833	146,696	153,995	1851	204,971	140,388
1834	119,983	70,872	1852	263,219	141,578
1835	125,316	72,499	1853	237,204	130,881
1836	220,119	154,985	1854	184,368	127,672
1837	269,992	133,037	1855	152,049	121,632
1838	281,268	112,557	1856	152,173	137,589
1839	259,308	105,473	1857	174,511	152,358
1840	246,076	89,613	1858	170,528	146,354
1841	263,224	110,537	1859	158,925	117,476
1842	287,384	116,811	1860	146,925	111,347

D. Goods Shipped to and from selected Other Ports in France (metric tons) 1. From Rouen to:

<u>Year</u>	<u>TOTAL</u>	<u>Meditn.</u>	<u>Dunkerque</u>	<u>LeHavre</u>	<u>Honfleur</u>	<u>Caen</u>	<u>Cherbourg</u>	<u>Brest</u>	<u>Nantes</u>	<u>Bordeaux</u>
1837	129,276	6,319	1,157	36,144	6,825	11,244	4,868	1,583	4,569	30,137
1838	92,443	1,233	1,154	28,938	3,883	12,096	6,615	1,312	5,394	10,296
1839	87,687	523	952	28,061	4,514	11,290	4,120	1,511	7,323	12,273
1840	71,215	1,424	4,650	13,906	3,705	10,004	1,532	3,816	5,342	10,809
1841	99,079	1,165	1,162	32,899	3,620	9,464	7,162	2,562	6,184	16,893
1842	90,148	1,696	727	24,347	4,240	12,721	6,559	2,719	5,110	12,632
1843	127,737	2,755	1,163	28,268	4,942	14,876	5,163	9,211	7,665	23,558
1844	163,495	6,195	1,014	43,948	11,909	13,692	5,029	9,127	8,371	21,069
1845	125,704	2,403	2,256	34,291	4,835	13,602	3,762	4,096	6,831	20,268
1846	114,575	2,266	1,783	33,172	3,958	11,794	6,801	6,165	6,587	11,692
1847	113,645	2,107	2,331	36,262	3,531	8,887	8,452	5,497	5,545	12,605
1848	85,677	973	1,014	18,816	1,931	11,061	10,831	7,949	3,280	97,770
1849	97,121	2,229	2,518	19,606	3,298	13,664	6,750	5,389	7,222	14,249
1850	120,959	2,562	2,725	29,324	4,629	12,621	5,742	7,627	5,645	25,671
1851	122,534	2,312	1,301	33,378	4,814	11,495	2,958	9,283	7,157	26,711
1852	109,573	3,555	1,401	28,312	3,665	11,026	1,512	1,830	7,846	27,093
1853	114,115	5,122	1,737	35,883	4,150	1,530	2,818	3,945	7,928	16,660
1854	136,602	2,745	806	53,452	4,509	14,367	7,953	6,581	5,013	16,364
1855	99,501	1,790	229	32,831	3,465	9,030	3,402	10,366	2,192	9,213
1856	83,339	2,880	301	19,041	2,802	9,230	6,078	6,997	1,336	9,755
1857	145,489	3,203	612	56,034	5,094	4,569	5,031	5,001	1,297	14,698
1858	50,629	1,179	2,618	1,806	3,324	2,896	4,440	4,091	1,532	6,993
1859	47,243	1,272	2,359	1,248	3,128	2,785	3,183	3,121	1,376	5,171
1860	49,896	786	1,927	5,427	2,428	2,143	3,120	2,840	642	6,460

D. Goods Shipped to and from selected Other Ports in France (metric tons)

2. To Rouen from:

Year	TOTAL	Meditn.	Dunkerque	LeHavre	Honfleur	Caen	Cherbourg	Nantes	Charente	Marennes	Bordeaux	Bayonne
1837	226,428	25,877	1,937	82,012	17,424	3,044	1,849	6,339	2,889	4,764	36,758	4,772
1838	285,769	32,441	2,026	102,146	19,134	3,374	1,164	4,919	2,361	4,544	58,627	6,257
1839	297,865	30,795	986	118,026	25,398	5,202	983	5,343	1,494	5,204	47,149	7,772
1840	291,180	22,371	695	134,655	24,130	3,598	841	2,141	1,939	7,044	42,665	6,266
1841	306,431	35,609	681	119,175	32,618	2,241	641	3,464	2,173	5,560	60,670	5,526
1842	307,024	38,226	1,035	112,790	29,258	3,756	1,131	6,700	1,771	3,509	52,560	6,793
1843	356,405	57,834	525	110,631	33,945	7,335	642	5,476	2,167	5,088	75,636	6,357
1844	318,720	50,788	800	91,201	28,637	5,024	5,435	10,243	2,123	1,292	54,846	7,979
1845	330,400	54,813	514	100,031	31,742	7,092	1,403	4,883	4,064	1,567	65,911	6,460
1846	419,445	54,583	736	145,222	44,147	6,626	842	6,466	3,949	3,850	80,382	8,999
1847	422,129	22,989	326	123,713	140,531	7,022	892	5,148	5,147	1,634	51,002	10,259
1848	176,865	26,130	319	50,007	10,668	3,781	273	5,983	1,861	3,502	37,174	4,738
1849	225,394	38,537	320	63,515	14,412	4,488	374	6,296	2,527	3,115	41,059	7,742
1850	223,365	40,322	456	65,233	15,795	4,205	429	5,736	2,621	3,640	43,601	7,825
1851	266,999	41,772	743	84,767	22,093	4,055	557	4,902	1,470	4,756	43,394	6,967
1852	392,647	71,809	690	76,944	32,853	5,815	448	10,734	3,081	5,694	10,938	12,031
1853	305,478	40,304	418	91,112	36,043	6,106	511	3,316	1,707	7,672	62,143	13,972
1854	232,047	40,236	602	86,234	25,401	9,426	548	4,433	810	5,767	25,009	5,554
1855	211,827	18,330	529	94,237	24,030	9,029	950	14,728	233	6,340	9,660	4,878
1856	196,319	15,578	239	109,632	23,271	5,910	782	3,273	-	4,562	1,965	1,136
1857	223,748	15,547	289	116,381	15,725	2,794	1,066	4,034	166	6,657	35,384	1,271
1858	173,580	15,057	670	101,902	20,042	2,064	560	882	573	1,787	9,220	907
1859	182,347	10,896	404	96,230	25,609	1,771	389	7,112	818	3,508	14,509	1,341
1860	140,696	10,965	527	54,550	24,478	2,924	593	642	86	-	6,460	2,733

APPENDIX II

Seaborne Shipping in the Port of LeHavreA. Sources

Statistics on both foreign and coasting trade into and out of LeHavre are contained in all of the same sources as those listed for Rouen, with the exception of the publication by the Chambre de commerce de Rouen.

B. Shipping to and from Foreign and Colonial Ports

(Total Net Registered Metric Tonnage of ships,
excluding ships in ballast)

<u>Year</u>	<u>Arrivals</u>	<u>Departures</u>	<u>Year</u>	<u>Arrivals</u>	<u>Departures</u>
1825	157,013	101,179	1843	426,049	299,658
1826	209,129	91,537	1844	393,780	293,325
1827	184,608	93,733	1845	456,429	303,304
1828	190,186	91,950	1846	486,093	313,484
1829	244,815	102,499	1847	599,644	330,548
1830	205,622	87,530	1848	356,459	277,642
1831	150,089	102,703	1849	391,362	315,014
1832	213,252	104,061	1850	417,927	327,336
1833	202,384	118,862	1851	495,593	419,769
1834	231,862	134,558	1852	509,416	431,421
1835	249,789	137,326	1853	605,556	456,767
1836	279,007	161,418	1854	631,580	509,481
1837	322,742	217,535	1855	760,419	485,176
1838	402,163	251,699	1856	912,514	575,195
1839	421,362	296,452	1857	964,132	650,306
1840	420,079	257,685	1858	939,033	601,265
1841	429,931	284,938	1859	860,626	574,631
1842	454,013	284,223	1860	950,471	611,472

C. Shipping to and from other Ports in France

(Total Net Registered Metric Tonnage of ships,
excluding ships in ballast)

<u>Year</u>	<u>Arrivals</u>	<u>Departures</u>	<u>Year</u>	<u>Arrivals</u>	<u>Departures</u>
1825	119,481	101,172	1843	146,224	219,398
1826	118,305	116,944	1844	190,176	213,536
1827	97,503	109,278	1845	204,625	217,899
1828	104,766	123,844	1846	234,401	260,378
1829	124,479	161,122	1847	261,117	243,059
1830	150,848	170,920	1848	161,607	163,351
1831	118,289	155,375	1849	164,364	169,078
1832	170,031	191,040	1850	156,409	184,583
1833	159,093	193,450	1851	179,247	191,304
1834	167,211	181,040	1852	193,287	201,170
1835	168,250	187,126	1853	210,627	210,187
1836	158,269	181,343	1854	179,328	230,294
1837	155,440	211,555	1855	184,478	224,674
1838	172,663	212,524	1856	251,358	239,783
1839	206,148	231,623	1857	291,515	288,116
1840	180,229	229,038	1858	300,466	265,684
1841	170,978	212,284	1859	258,890	263,465
1842	180,700	228,376	1860	249,287	234,371

D. Goods Shipped to and from selected Other Ports in France (metric tons)

1. To LeHavre from:

Year	TOTAL	Meditrn.	Bordeaux	Nantes	Morlaix	Cherbourg	Lwr Ndy	Caen	Honfleur	Dunkerque
1837	150,911	25,433	8,115	1,796	641	2,559	14,828	4,743	13,239	3,557
1838	154,074	25,735	12,137	2,150	769	3,444	7,269	3,238	15,761	4,085
1839	134,337	21,951	17,842	1,974	1,910	3,013	9,162	6,036	7,193	3,232
1840	125,916	15,143	18,064	1,545	3,801	2,826	19,057	3,939	13,329	3,733
1841	126,206	16,387	12,474	1,704	3,096	2,048	10,208	4,882	11,993	3,256
1842	141,456	18,824	10,412	3,318	3,151	2,744	13,772	5,649	17,715	2,810
1843	123,169	12,525	8,965	1,849	8,651	4,909	7,580	5,482	13,343	3,511
1844	144,963	12,416	10,969	1,539	3,001	8,516	7,588	5,714	12,817	6,327
1845	146,060	16,370	13,173	2,298	3,512	2,225	8,541	7,015	12,165	6,921
1846	181,194	20,085	13,247	2,670	4,194	2,186	14,731	9,277	15,170	6,495
1847	206,742	29,963	25,732	2,336	3,407	1,073	19,822	7,400	19,230	5,387
1848	125,214	14,744	18,945	9,005	2,541	941	12,482	4,407	8,586	3,438
1849	113,636	13,893	18,009	2,663	3,755	1,330	5,333	5,406	8,336	4,426
1850	110,742	12,852	14,731	1,765	3,560	2,172	5,241	4,830	10,753	4,032
1851	138,363	15,606	19,667	2,099	3,603	2,436	7,179	5,578	15,878	4,558
1852	152,438	12,320	20,475	7,491	4,997	2,926	7,381	8,813	18,748	5,489
1853	169,585	13,230	22,014	3,658	7,141	2,880	9,759	12,789	19,584	5,692
1854	173,850	12,586	8,121	4,036	5,799	2,244	8,204	14,020	21,540	6,613
1855	153,914	6,639	5,121	4,347	7,314	2,884	5,989	15,466	19,913	8,592
1856	142,513	4,094	3,442	5,609	5,785	2,159	4,376	10,727	27,649	11,422
1857	182,364	6,126	11,249	5,993	6,823	2,865	4,438	12,355	26,213	5,933
1858	159,866	7,123	12,980	3,063	12,323	4,098	2,773	11,619	32,786	9,004
1859	142,596	6,962	10,599	4,096	9,506	3,932	3,149	9,643	25,874	8,587
1860	131,248	5,995	11,885	7,450	8,707	1,475	1,200	11,868	19,219	9,834

* Includes St.-Vaast, Carentan, Isigny and Sallenelles.

D. Goods Shipped to and from selected Other Ports in France (metric tons)

2. From LeHavre to:

<u>Year</u>	<u>TOTAL</u>	<u>Meditrn.</u>	<u>Bayonne</u>	<u>Bordeaux</u>	<u>Nantes</u>	<u>Morlaix</u>	<u>Cherbourg</u>	<u>Caen</u>	<u>Honfleur</u>	<u>Dunkergue</u>
1837	117,207	1,821	1,122	4,282	1,457	1,758	1,605	4,046	2,827	2,723
1838	137,279	1,075	432	3,467	1,793	945	1,748	6,175	2,334	3,785
1839	153,282	515	785	4,553	1,524	1,660	1,502	6,841	2,395	2,871
1840	181,829	618	870	4,646	2,540	2,543	2,714	9,688	4,604	3,967
1841	163,023	517	866	8,111	2,042	2,792	2,074	8,343	1,407	5,833
1842	159,507	1,000	801	6,038	1,795	3,190	1,946	8,617	2,519	4,294
1843	157,731	1,400	964	6,038	2,479	3,128	1,896	8,133	2,149	6,398
1844	142,629	1,359	643	6,895	1,482	3,604	2,044	10,521	2,116	5,948
1845	148,389	8,424	470	6,390	979	2,846	2,799	10,842	1,601	6,782
1846	201,429	1,263	526	5,132	1,564	3,585	2,951	11,490	1,843	7,601
1847	202,305	1,301	440	9,197	1,385	3,916	5,260	16,023	2,126	5,821
1848	91,696	833	599	6,427	1,542	2,916	3,329	8,006	709	3,584
1849	117,260	1,508	507	10,753	1,867	4,508	3,875	10,612	1,028	5,072
1850	129,639	1,674	521	12,649	3,059	4,459	4,053	11,724	1,735	5,659
1851	141,327	1,005	448	13,807	3,242	3,335	4,218	10,602	1,503	4,014
1852	138,538	1,197	496	11,163	2,781	3,747	4,675	11,643	1,920	7,188
1853	166,540	1,174	529	10,717	3,078	5,286	8,427	19,771	3,086	5,882
1854	181,327	1,307	505	6,087	2,686	7,593	10,343	32,035	3,482	6,870
1855	192,055	2,352	831	10,388	2,446	6,499	7,578	25,889	4,090	13,158
1856	217,339	984	791	8,396	2,593	6,964	7,142	30,361	3,116	9,193
1857	238,359	490	648	15,016	2,496	7,523	10,088	23,529	3,276	11,990
1858	208,066	628	434	16,928	2,582	8,249	8,793	25,174	3,330	8,107
1859	205,853	546	1,058	18,169	5,167	7,734	5,155	21,078	10,901	8,574
1860	162,145	585	814	14,374	2,887	7,222	3,812	18,008	13,521	7,775

APPENDIX III

Water-Borne Transport on the Lower SeineA. Sources

The principal source for these statistics is:

Chambre de commerce de Rouen. Statistiques du Commerce maritime du port de Rouen de l'année 1843 à 1867. (Rouen 1844-1868).

Others were found in:

Archives départementales de la Seine-Maritime. Series M, Commerce et industrie, Statistique industrielle et commerciales, enquêtes (1820-1837).

A valuable source for the very early period is:

S. Flachet. Du Canal Maritime de Paris à Rouen. (Paris December 1829) vols 1 to 4.

An equally valuable source for the 1850s is the weekly publication, Le Moniteur de la Marine, of which there is a full set in the Bibliothèque Nationale, Paris.

B. Goods Transported by River between Rouen and Paris

(metric tons)

<u>Year</u>	<u>Upstream</u>	<u>Downstream</u>	<u>Year</u>	<u>Upstream</u>	<u>Downstream</u>
1818	120,832*	163,965	1840	227,533	158,864
1819	73,342	167,500	1841	264,624	180,255
1820	98,834	155,044	1842	248,468	168,383
1821	133,144	175,103	1843	336,687	241,525
1822	149,456	169,852	1844	244,263	162,196
1823	107,352	175,552	1845	272,668	164,943
1824	149,836	198,303	1846	237,058	150,885
1825	156,648	179,899	1847	242,407	144,176
1826	179,421	190,871	1848	128,372	86,779
1827	112,712	-**	1849	158,045	154,079
1828	136,028	-	1850	183,983	149,857
1829	182,415	-	1851	212,872	165,365
1830	209,056	-	1852	288,418	166,844
1831	145,801	-	1853	281,082	170,714
1832	176,276	-	1854	214,031	164,529
1833	202,984	-	1855	234,042	191,732
1834	170,061	-	1856	247,889	178,387
1835	179,668	-	1857	244,413	180,822
1836	170,638	-	1858	246,226	209,087
1837	218,507	-	1859	238,548	198,728
1838	244,558	-	1860	241,075	208,742
1839	233,998	162,223			

* Figures for 1818 to 1838 include goods transported from Rouen to Oise.

** Unknown.

C. Goods Transported by River between Rouen and the Oise

(metric tons)

<u>Year</u>	<u>Upstream</u>	<u>Downstream</u>	<u>Year</u>	<u>Upstream</u>	<u>Downstream</u>
1818	*	*	1840	6,570	28,561
1819	-	-	1841	4,070	42,657
1820	-	16,793	1842	10,382	36,002
1821	-	26,907	1843	6,836	52,682
1822	-	27,120	1844	6,881	106,004
1823	-	46,495	1845	8,573	88,940
1824	-	31,053	1846	8,900	75,885
1825	-	46,537	1847	5,724	70,223
1826	-	41,185	1848	4,682	68,890
1827	-	51,165	1849	8,128	98,000
1828	-	*	1850	13,519	101,632
1829	-	-	1851	14,176	109,516
1830	-	-	1852	13,138	127,726
1831	-	-	1853	20,089	103,627
1832	-	-	1854	31,241	157,106
1833	-	-	1855	21,001	102,839
1834	-	-	1856	28,606	120,254
1835	-	-	1857	21,252	121,570
1836	-	-	1858	19,439	89,605
1837	-	-	1859	26,780	113,413
1838	-	-	1860	27,885	104,264
1839	7,043	25,948			

* Unknown.

D. Goods Transport Downstream to Rouen, by Vessel Type

(metric tons)

<u>Year</u>	<u>Grande Vitesse</u>	<u>Remorqués</u>	<u>Halés</u>
1847	*	35,330	206,790
1848	-	24,370	155,551
1849	-	28,493	193,399
1850	-	39,593	193,587
1851	-	54,636	178,098
1852	7,621	48,658	163,938
1853	20,347	53,407	217,909
1854	30,930	48,695	194,972
1855	33,575	51,442	209,553
1856	64,709	42,313	191,619
1857	62,255	67,440	173,237
1858	67,529	63,568	167,595
1859	66,825	82,352	162,963
1860	84,582	93,756	134,402

* None.

E. Goods Transported Upstream by River from Rouen (metric tons).

	1838	1839	1840	1841	1842	1843	1844	1845	1846	1847	1848	1849
Bois communs	25,412	23,661	21,798	24,300	25,342	42,590	21,963	26,650	39,402	33,358	7,483	14,976
Sel marin	11,688	13,708	13,704	12,049	12,088	10,913	8,179	10,486	9,194	10,804	10,477	13,766
Bois de teinture	7,109	4,458	2,201	6,090	6,789	9,142	6,005	4,351	4,524	4,550	1,967	6,281
Marbres	-	14,505	9,624	8,738	9,025	10,778	10,811	18,890	15,455	15,785	10,856	7,178
Graines et farines	571	6,915	17,654	479	949	8,954	925	577	6,831	46,632	3,787	191
Fer et fontes	-	15,536	14,120	11,942	12,226	13,702	10,024	8,071	13,999	18,273	11,397	5,663
Bois d'aberristerie	-	2,401	4,496	1,309	1,000	2,141	1,061	4,461	4,624	4,481	1,172	2,626
Riz	-	1,582	2,304	1,614	2,256	2,105	1,407	1,148	2,824	2,361	-	1,836
Savons	7,535	6,414	4,780	4,840	4,098	6,923	2,972	3,119	954	414	1,680	1,383
Plomb	-	3,220	2,990	4,602	4,539	5,455	5,866	3,228	3,100	3,159	1,690	1,664
Zinc	-	5,530	4,107	5,660	2,888	4,355	2,820	3,409	5,200	5,365	1,100	2,627
Sucre	20,834	20,834	20,701	24,794	25,761	24,341	26,280	27,626	22,606	16,851	4,715	18,696
Potasse	-	-	3,716	4,182	4,236	5,622	4,982	5,341	1,729	4,470	2,195	3,218
Soufre	-	2,861	2,875	3,439	4,272	2,926	3,051	2,512	1,896	2,825	2,605	4,609
Tabac	2,865	3,079	3,453	4,899	2,860	4,317	4,078	4,040	2,997	1,342	2,204	8
Huiles	-	4,006	5,549	6,827	4,311	3,507	2,246	3,058	1,730	2,297	1,301	1,776
Fruits oléagineux	-	-	855	1,675	1,722	3,000	-	-	-	664	211	477
Liaux-de-vie	-	2,001	3,428	13,202	14,679	16,925	6,770	5,048	1,534	2,065	1,186	3,254
Sulf brut	-	61	114	3,151	5,113	2,206	3,319	1,576	740	624	49	419
Café	4,130	2,847	4,995	4,790	2,472	2,174	1,856	2,475	2,556	925	1,076	1,372
Cuivre	2,488	1,265	1,070	2,999	3,118	3,089	1,172	1,938	1,100	1,430	355	472
Coton brut	4,494	1,174	3,617	4,418	2,625	2,157	260	2,188	423	204	934	675
Peaux	-	1,123	1,564	1,650	2,538	2,256	1,670	705	2,111	917	442	939
Vins	72,587	69,120	53,201	72,139	55,553	101,544	80,251	94,641	73,818	48,711	47,046	42,509
Etain	-	60	125	1,529	1,441	1,376	939	962	60	79	233	390
Autres	62,453	34,675	30,917	37,377	46,949	50,487	42,237	44,873	26,497	20,209	17,104	29,596
TOTALS	244,558	241,041	234,103	268,694	258,850	343,523	251,144	281,421	245,958	248,131	133,054	166,179

E. Continued.

	<u>1850</u>	<u>1851</u>	<u>1852</u>	<u>1853</u>	<u>1854</u>	<u>1855</u>	<u>1856</u>	<u>1857</u>	<u>1858</u>	<u>1859</u>	<u>1860</u>
Bois Communs	22,723	19,882	26,350	33,079	14,269	27,937	30,124	34,124	34,713	34,231	47,023
Sel marin	13,171	15,383	13,281	11,819	10,224	11,100	12,139	11,243	1,294	2,099	1,319
Bois de teinture	5,982	5,904	7,850	6,628	6,541	8,546	8,006	9,177	6,354	7,535	9,755
Marbres	8,837	10,369	12,556	10,960	11,551	12,408	12,672	12,699	12,146	12,172	3,625
Graines et farines	323	78	1,081	19,450	20,336	9,503	22,074	7,079	2,009	916	2,691
Fer et fontes	9,398	9,947	13,138	17,994	16,560	38,648	32,251	22,453	19,403	13,937	16,254
Bois d'ébenisterie	4,827	3,378	5,990	4,526	3,696	6,241	7,118	8,489	6,529	7,462	9,526
Riz	1,892	2,636	3,338	4,421	9,911	5,033	8,094	11,181	2,577	4,725	4,354
Savons	4,581	5,867	4,302	3,131	4,096	4,216	2,254	942	1,394	3,252	3,363
Plomb	3,028	2,674	2,649	1,371	2,070	2,012	1,407	1,354	935	983	1,048
Zinc	6,076	4,581	9,925	4,337	3,733	3,254	1,886	2,608	3,652	2,742	2,659
Sucre	12,946	12,053	11,326	10,577	15,534	11,700	9,319	9,788	10,367	13,932	14,021
Potasse	5,984	7,790	8,595	7,597	9,586	6,265	7,243	11,903	9,684	7,786	8,328
Other chemicals	-	-	-	10,018	2,730	2,615	3,344	3,279	4,216	3,418	3,877
Soufre	3,589	3,684	4,831	5,205	5,001	5,346	6,219	5,249	4,110	4,707	4,301
Tabacs	12	21	9	133	-	-	-	-	-	-	-
Huiles	1,818	3,651	3,899	5,231	7,426	6,332	9,175	9,353	11,472	10,216	12,083
Fruits oléagineux	1,995	425	752	1,128	8,312	6,342	3,999	8,519	5,638	6,137	5,663
Eaux-de-vie	2,137	3,337	2,136	2,746	2,276	2,421	3,032	5,694	2,005	1,040	955
Suif brut	637	139	237	378	186	1,520	1,365	1,519	444	234	846
Café	1,243	595	289	288	206	1,541	1,583	1,926	1,195	2,521	4,852
Cuivre	1,044	1,038	1,594	1,629	3,387	4,090	2,398	4,331	2,767	2,226	3,952
Coton brut	4,237	161	1,931	667	1,579	2,632	8,370	12,952	15,038	20,468	16,401
Peaux	1,552	1,073	1,512	715	1,316	3,108	1,500	1,268	2,156	2,922	4,735
Vins	52,943	78,874	119,686	89,664	37,049	14,993	6,564	4,760	1,676	3,297	2,734
Tissus de coton	-	-	-	-	4,096	5,639	9,158	7,662	9,873	12,633	13,260
Etain	781	592	258	283	500	403	545	687	421	448	343
Autres	25,741	32,716	44,500	47,188	40,410	42,189	64,466	72,269	94,079	82,749	69,017

TOTALS

197,502 227,048 301,556 301,171 245,274 255,043 276,495 283,297 265,665 265,328 268,960

F. Goods Transported Downstream by River to Rouen (metric tons)

	<u>1850</u>	<u>1851</u>	<u>1852</u>	<u>1853</u>	<u>1854</u>	<u>1855</u>	<u>1856</u>	<u>1857</u>	<u>1858</u>	<u>1859</u>	<u>1860</u>
Houille	59,947	57,454	54,717	102,217	91,695	74,969	73,741	63,319	45,796	66,519	63,476
Blés et farines	17,530	13,928	11,678	9,195	7,212	4,260	4,509	8,300	20,370	37,478	20,967
Métaux	1,675	9,335	9,373	11,835	13,367	21,488	26,977	28,305	15,993	18,534	12,285
Sucres	-	1,151	717	706	1,362	2,865	1,757	4,634	11,024	6,268	5,269
Vins et liquides	595	2,843	1,064	2,548	4,099	4,758	6,610	8,221	5,998	4,399	4,585
Fûts vides	-	779	2,059	3,632	2,422	2,519	2,288	1,893	1,159	1,503	1,165
Pierres à bâtir	1,354	7,340	9,684	12,841	10,916	16,338	20,707	19,520	10,979	11,201	11,849
Pommes de terre	7,236	2,128	12,299	7,699	498	1,416	949	4,810	27,109	6,356	3,591
Drogueries	-	2,129	5,630	10,697	13,239	13,655	18,373	21,622	21,825	31,687	36,912
Verreries	-	-	599	2,781	3,900	2,986	4,437	3,307	2,992	2,172	2,769
Plâtre	93,574	80,545	87,036	88,153	90,980	90,942	74,239	77,574	74,801	70,479	78,447
Tissus divers	-	-	-	1,212	3,636	5,797	7,405	8,193	9,289	9,679	9,054
Matériaux	-	2,435	2,668	3,316	6,018	9,238	12,872	11,278	14,562	12,461	17,362
Bois communs	-	5,005	5,767	5,752	7,715	20,405	19,558	17,282	15,530	13,215	18,567
Autres	51,269	57,229	31,587	41,812	17,537	22,934	24,218	24,674	21,259	20,790	20,442

TOTAL

233,180 232,734 220,217 291,663 274,597 294,571 298,641 302,932 298,692 312,141 312,739

G. Goods Transported by River from LeHavre and Honfleur to Rouen* (metric tons)

	1850	1851	1852	1853	1854	1856*	1857	1858	1859	1860
Coton en laine	8,295	9,115	12,990	11,624	7,373	13,244	17,005	20,189	25,450	17,083
Bois de teinture	6,790	6,696	9,956	8,281	7,254	9,573	9,560	8,098	8,641	10,999
Bois de construction	15,122	10,018	16,230	23,578	7,551	14,111	19,273	19,230	21,895	31,806
Bois d'ébenisterie	2,640	3,604	4,084	4,200	3,153	6,630	8,027	5,847	7,441	8,599
Métaux	7,155	8,280	11,333	8,080	9,106	19,514	18,910	16,214	13,678	13,270
Vins	3,932	5,966	4,084	5,963	1,373	2,104	5,027	1,140	747	1,506
Tabacs, sucre, riz	12,215	6,994	13,724	16,148	23,450	19,238	23,628	15,838	25,018	26,947
Drogueries	4,810	8,899	6,231	7,074	11,557	18,725	23,600	12,247	14,651	16,394
Blés et farines	-	-	-	11,564	11,031	10,028	6,208	1,343	620	1,672
Cuir et peaux	-	-	-	-	-	-	-	2,619	2,938	6,457
Autres	9,536	25,971	22,783	18,865	21,294	20,398	29,374	36,474	32,777	21,668

TOTALS 70,495 85,545 101,415 115,376 103,142 133,566 160,615 139,242 153,859 156,401

* To the 'port fluviale' in Rouen, ie upstream from the bridges; these figures do not therefore include goods carried by coasting vessels from LeHavre and Honfleur to the 'port maritime' at Rouen.

** No figures available for 1855.

APPENDIX IV

Railway Capital Expenditures and FundsA. Sources

All data are taken from Reports to shareholders contained in the Journal des Chemins de Fer.

B. Capital Expenditures

	<u>Paris-to- Rouen</u>	<u>Rouen-to- LeHavre</u>	<u>Rouen-to- Dieppe</u>
Expenses before company incorporation	592,155*	188,604	46,335
General Costs	1,050,122	1,080,738	327,089
Land	5,639,177	9,502,131	1,800,680
Engineering services ...	558,305	783,758	328,857
Earth Works, Bridges, etc	27,272,663	24,699,950	7,232,902
Stations	6,372,285	9,877,718	973,994
Iron Way	9,271,551	6,317,687	2,185,159
Rolling Stock	7,356,558	3,201,424	132,337
Interest on Equity before opening of railway ..	1,590,816	1,767,513	745,779
Interest on Bonded Debt before opening of railway	347,177	484,765	-
Loss on issue of equity or bonds	171,975	1,226,555	32,325
Less Interest on idle funds during construction	862,187	385,689	-
Less Resale of Land ...	-	315,672	-
Share in construction of Crossing of Rouen ..	6,953,555	-**	-
Expenses re Fécamp project	-	-	154,623
TOTAL	66,314,152	57,290,309	13,960,008 F
GRAND TOTAL	137,564,469 F		

* This includes 450,410 F for acquisition of studies made by Riant et Cie.

** The contribution of the Rouen-to-LeHavre company to the cost of the crossing of Rouen was not given separately in the company's accounts.

C. Capital FundsParis-to-Rouen Company

Equity (72,000 shares @ 500F)	36,000,000F
State Loan @ 5%	14,000,000
Loan of 1845 @ 4%	6,000,000
Loan of 1847 @ 5%	5,000,000
Loan of 1849 @ 4%	3,000,000
State Loan of 1844 @ 3%	4,000,000
TOTAL	68,000,000F

Rouen-to-LeHavre Company

Equity (40,000 shares @ 500F)	20,000,000F
State Grant	8,000,000
Grant from LeHavre	1,000,000
State Loan @ 3%	10,000,000
Loan of 1846 @ 5%	10,000,000
Loan of 1847 @ 5%	5,000,000
Loan of 1847 @ 5%	5,000,000
TOTAL	59,000,000F

Rouen-to-Dieppe Company

Equity (36,000 shares @ 400F)	14,400,000F
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APPENDIX V

Railway Company Operating AccountsA. Sources

The data included in the tables below are taken from the accounts of the Paris-to-Rouen railway company and the Rouen-to-LeHavre railway company, which were published with their semi-annual reports to shareholders in the Journal des Chemins de Fer. One exception is the report to shareholders of the Paris-to-Rouen company for the period ending December 1847; owing to the Revolution of 1848, the Journal des Chemins de Fer ceased publication for several weeks. These figures were obtained therefore from Arch. Nat. 65 AQ E.563, which contains all of this company's reports from 1842 to 1854.

No accounts are given for the Rouen-to-Dieppe company, because it published its own accounts for only three accounting periods, from July 1848 to March 1851. On the 1st of April 1851 its operations were managed by the Paris-to-Rouen company; from that time on the accounts of the latter company include costs and revenues from the Rouen-to-Dieppe line.

The accounts given below end at the end of 1854. From the 1st of January 1855, their operations were merged with those of the new Cie des Chemins de Fer de l'Ouest. This company's accounts were not sufficiently detailed to determine the costs and revenues from the individual former companies' lines.

B. Paris-to-Rouen Railway Company, Operating Accounts
(see page 307)C. Rouen-to-LeHavre Railway Company, Operating Accounts
(see page 309)

B. Paris-to-Rouen Railway Company, Operating Accounts

Period Ending:	Sep 1843	Mar 1844	Sep 1844	Jun 1845	Dec 1845	Jun 1846	Dec 1846	Jun 1847
Operating Costs	764,182	979,567	1,609,458	2,437,467	1,941,159	2,088,924	2,328,522	2,362,965
Fixed Capital Charges	104,333	192,500	210,000	315,000	210,000	210,000	210,000	366,316
TOTAL COSTS	868,515	1,172,067	1,819,458	2,752,467	2,151,159	2,298,924	2,538,522	2,729,281
Passengers and Baggage	1,949,523	1,654,620	2,914,676	3,007,676	2,789,784	2,185,822	2,599,508	2,130,069
Goods "grande vitesse"	109,070	158,665	181,159	261,114	213,162	190,553	248,622	403,255
Goods "petite vitesse"	107,779	466,000	763,902	1,363,491	991,271	1,299,842	1,678,761	1,968,544
Other *	11,568	10,788	17,799	16,028	9,739	7,675	3,693	159,542
TOTAL RECEIPTS	2,178,403	2,290,076	3,877,535	4,718,386	4,153,203	3,716,702	4,638,996	4,669,557
Operating Income	1,414,221	1,310,509	2,268,127	2,280,919	2,212,044	1,627,778	2,310,474	2,306,492
RETURN ON CAPITAL (%)	7.37	5.24	9.07	6.08	8.19	5.42	7.70	7.68
RETURN ON EQUITY (%)	8.73	6.21	11.4	10.9	11.1	7.88	11.7	10.8
Period Ending:	Dec 1847	Jun 1848	Dec 1848	Jun 1849	Dec 1849	Jun 1850	Dec 1850	Jun 1851
Operating Costs	2,544,674	1,802,557	2,053,177	1,963,519	2,098,314	1,855,901	2,293,445	1,285,652
Fixed Capital Costs	486,829	479,473	558,391	581,476	638,908	633,120	887,287	876,758
TOTAL COSTS	3,031,503	2,282,040	2,611,568	2,544,995	2,737,222	2,489,021	3,180,732	2,862,410
Passengers and Baggage	2,753,638	1,489,898	1,934,966	1,602,086	2,350,330	1,807,042	2,700,344	1,875,556
Goods "grande vitesse"	518,992	320,038	366,845	329,725	394,933	360,772	381,120	336,939
Goods "petite vitesse"	1,902,996	884,612	1,305,754	1,600,255	1,685,322	1,555,612	1,726,386	1,585,496
Other *	177,803	152,337	114,438	163,271	211,774	209,595	363,827	255,211
TOTAL RECEIPTS	5,363,242	2,846,884	3,822,332	3,595,345	4,652,210	3,933,025	5,172,676	4,053,222
Operating Income	2,818,568	1,044,317	1,769,155	1,631,826	2,526,896	2,077,124	2,879,231	2,067,556
RETURN ON CAPITAL (%)	9.40	3.48	5.90	5.44	7.43	6.10	8.47	5.53
RETURN ON EQUITY (%)	13.0	3.14	6.73	5.34	10.5	8.2	11.06	5.91

B. (cont'd) Paris-to-Rouen Railway Company, Operating Accounts

Period Ending:	<u>Dec 1851</u>	<u>Jun 1852</u>	<u>Dec 1852</u>	<u>Jun 1853</u>	<u>Dec 1853</u>	<u>Jun 1854</u>	<u>Dec 1854</u>
Operating Costs	2,221,476	2,103,455	2,422,923	2,281,830	2,785,899	2,426,764	2,383,307
Fixed Capital Costs	876,655	876,759	876,777	876,339	875,920	835,030	835,953
TOTAL COSTS	3,098,131	2,980,214	3,299,700	3,158,169	3,661,819	3,261,794	3,219,032
Passengers and Baggage	2,636,002	2,088,905	2,925,014	2,205,666	3,149,477	2,332,688	3,162,282
Goods "grande vitesse"	371,900	343,971	416,762	412,696	484,319	407,810	443,836
Goods "petite vitesse"	1,688,926	1,877,200	1,896,720	2,141,924	2,502,630	2,285,609	2,429,186
Other*	315,208	265,665	337,222	306,734	470,503	321,808	373,895
TOTAL RECEIPTS	5,009,850	4,575,742	5,573,712	5,067,020	6,606,929	5,375,684	6,439,646
Operating Income	2,788,374	2,472,287	3,150,789	2,785,519	3,821,030	2,948,920	4,056,339
RETURN ON CAPITAL (%)	6.77	6.0	7.65	6.76	9.27	7.16	9.84
RETURN ON EQUITY (%)	7.59	6.33	9.02	7.58	11.69	8.39	12.78

* Includes revenue from the carriage of mail and other (non-operating) revenue.

C. Rouen-to-LeHavre Railway Company, Operating Accounts

Period Ending:	Aug 1847	Feb 1848	Aug 1848	Feb 1849	Aug 1849	Feb 1850	Aug 1850	Feb 1851
Operating Costs	865,722	927,414	885,108	877,646	916,875	851,143	849,655	820,960
Fixed Capital Charges	350,111	471,778	464,481	480,876	546,025	556,796	612,371	696,610
TOTAL COSTS	1,215,833	1,399,192	1,349,589	1,358,522	1,462,900	1,407,939	1,462,026	1,517,570
Passengers and Baggage	805,438	689,481	655,585	648,288	816,658	660,073	950,124	765,303
Goods "grande vitesse"	165,008	156,746	125,653	149,402	146,415	164,383	167,911	162,203
Goods "petite vitesse"	703,938	834,222	276,364	680,582	771,938	730,151	698,618	708,882
Other*	44,776	51,993	51,020	64,958	62,554	96,660	81,911	83,741
TOTAL RECEIPTS	1,718,959	1,742,441	1,129,623	1,543,132	1,797,564	1,649,294	1,893,516	1,720,226
Operating Income	853,237	815,237	244,515	665,486	880,689	843,151	1,048,861	899,266
RETURN on CAPITAL (%)	3.16	3.02	0.91	2.46	3.04	2.91	3.62	3.11
RETURN on EQUITY (%)	5.03	3.43	-	1.85	3.35	2.41	4.37	2.03

Period Ending:

	Aug 1851	Feb 1852	Aug 1852	Feb 1853	Aug 1853	Feb 1854	Aug 1854	Dec 1854
Operating Costs	849,612	824,330	387,417	924,671	1,039,979	1,174,731	1,027,124	753,122
Fixed Capital Charges	696,610	696,660	696,185	696,132	696,361	696,310	695,861	463,905
TOTAL COSTS	1,546,222	1,520,990	1,583,602	1,602,803	1,736,340	1,871,041	1,722,985	1,217,027
Passengers and Baggage	963,772	741,704	1,049,449	809,223	1,095,084	907,218	1,177,558	706,112
Goods "grande vitesse"	176,035	152,580	163,190	189,909	206,582	202,911	208,824	116,719
Goods "petite vitesse"	692,211	752,503	799,772	903,293	1,112,944	1,348,976	1,156,843	837,206
Other*	71,392	74,463	71,691	110,905	75,839	100,204	72,430	46,174
TOTAL RECEIPTS	1,903,409	1,721,210	2,084,102	2,023,330	2,490,448	2,253,211	2,535,656	1,707,303
Operating Income	1,053,797	896,880	1,196,685	1,098,659	1,450,469	1,078,480	1,508,532	972,181
RETURN on CAPITAL (%)	3.64	3.10	4.13	3.79	5.01	3.72	5.21	5.02
RETURN on EQUITY (%)	3.58	2.01	5.01	4.03	7.55	3.83	8.49	7.74

* Includes revenue from the carriage of mail, payments from the Rouen-to-Dieppe company to cover the interest on the value of rolling stock borrowed from the Rouen-to-LeHavre company, and other (non-operating) revenue.

NOTES

1 H. Cavaillès, La route française; son histoire, sa fonction, (Paris 1946); Pierre Dauzet, Le siècle des chemins de fer en France, 1821-1938, (Fontenay-aux-Roses 1948).

2 The most important of these are his thorough study of the origins of the Cie de l'Est, Une étape de la construction des grandes lignes de chemins de fer en France. La ligne de Paris à la frontière d'Allemagne (1825-1852), (Paris 1932), 4 volumes. Also very valuable is L'ère du rail, (Paris 1954).

3 Monographs on the development of railways in the Rhône valley: Les oppositions locales aux chemins de fer dans la vallée du Rhône, 1832-33, (Montpellier 1924), and Essai historique sur les premier chemins de fer du Midi languedocien et de la vallée du Rhône, (Montpellier 1935). This was followed by Une Bataille de réseaux: Besançon, l'Est et la P.L.M. (1842-1860), (Montpellier 1937), and finally two things of a more general nature, "Les grandes étapes du réseau Ferroviaire Français", Revue des Deux Mondes, 15 September 1941, and Géographie des chemins de fer, (Paris 1942).

4 Most notably La Politique des Travaux Publics du Second Empire, (Paris 1952), and "Transport", in Cambridge Economic History of Europe, vol 6, The Industrial Revolution and After, (Cambridge 1965), part I, pp 212-273.

5 Potentially most interesting is M. Caron's recently completed thèse de doctorat d'Etat, "Histoire de l'exploitation d'un grand réseau français: la Compagnie des Chemins de Fer du Nord de 1846 à 1936", reported in "Soutenance de Thèse pour le doctorat ès lettres en Sorbonne", Revue historique, No. 494 (April-June 1970), pp 522-529. It is to be hoped this will soon be published.

6 There are very useful sections on public works and transport in La banque et le crédit en France, 1815 à 1848, (Paris 1959); and in Recherche sur la formation de la grande entreprise capitaliste (1815-1848), (Paris 1959). A valuable reference is "Les Archives des compagnies de chemin de fer", in Histoire des Entreprises, vol 1 (1958).

7 Girard, "Transport", op. cit., p 213.

8 A somewhat similar work has been published by Félix Rivet, La navigation à vapeur sur la Saône et le Rhône (1783-1863), (Paris 1962). Based upon the extensive records of several large steamer companies at Lyon, this book examines in great detail the development of steamer services and their subsequent competitive struggle with the railway. It adopts wholeheartedly the point of view of the steamer companies. It is conspicuously lacking in any form of quantitative analysis, and contains no systematic presentation of traffic statistics.

- 1 These figures and the information following on goods brought to Paris by water are taken from several tables contained in a publication by the Département de la Seine, Recherches statistiques sur la ville de Paris et le département de la Seine, (Paris 1821-1829), vol 2.
- 2 Stéphane Flachet, Du Canal maritime de Paris à Rouen, (Paris December 1829), vol 2, pp 288-295.
- 3 See Pierre Dardel, Navires et Marchandises dans les ports de Rouen et LeHavre au XVIII siècle, (Paris 1963).
- 4 Ibid., p 241.
- 5 Flachet, op. cit., vol 2, p 121.
- 6 In published works and documents these terms are sometimes confused; here they will be used consistently as defined in the text.
- 7 L. Sekutowicz, La Seine Maritime. Etude sur l'importance économique du port de Rouen, (Paris 1903), 16.
- 8 Chambre de Commerce de Rouen, Enquête sur les travaux à faire pour l'amélioration de la navigation de la basse-Seine, (Rouen November 1844), p 87; H. Wallon, Le Magasin de Sauvetage de Quillebeuf et les services qu'il a rendu à la navigation de la Seine, (Rouen 1902), 154.
- 9 P.-F. Frissard, Navigation fluviale du Havre à Paris. Amélioration de la navigation du Havre à Rouen, (LeHavre 1832), p 34.
- 10 Doyat, Rapport sur les enquêtes faites sur les projets présentés pour l'amélioration de cette rivière (the Seine)..., (Rouen 4 December 1850), p 158.
- 11 Belleville, La Seine Maritime pendant un demi-siècle (1849-1899), (Rouen 1900), p. 6.
- 12 H.-L. Partiot, Etude sur les rivières à marée et sur les estuaires, (Paris 1892), p 98.
- 13 CC Rouen, Enquêtes sur deux projets d'endiguement de la Seine Maritime...arrêté de M. le Ministre des Travaux Publics du 16 Juillet 1850, (Rouen August 1850), p 65.
- 14 Sekutowicz, op. cit., p 40; Archives départementales de la Seine-Maritime, Series S, Navigation de la Seine, affaires diverses (D).
- 15 Abbé Anthiaume, Le Navire, sa propulsion en France et principalement chez les Normands, (Paris 1924), p 33.

16 Ibid., p 4.

17 Frissard, op. cit., p 35.

18 Chambre de commerce de Rouen, Etat des économies que la navigation de la Basse-Seine devra éprouver si les améliorations projetées ont lieu, comparatives aux dépenses qu'elle à supporter dans l'état actuel des choses, (Rouen 22 February 1845).

19 Flachat, op. cit., vol 2, p 451-2. See also E. Grangez, Discussion et documents sur les canaux, sur les routes et sur les chemins de fer de la France, (Paris 1830), p 167.

20 Arch. Nat. Fl4.1270, Seine-Inférieure, LeHavre; Flachat, op. cit., vol. 2, p 94; Bérigny, Navigation maritime du Havre à Paris, (Paris March 1826), p 71; Wallon, op. cit., p 155.

21 Bérigny, op., cit., p 75 gives both rates and costs for allèges; a very good set of cost tables for the Seine is given in Tourasse and Mellet, Essai sur les bateaux à vapeur..., (Paris 1828-29), p 212f. See also Arch. Nat. Fl4.1270, Seine-Inférieure, LeHavre.

22 These figures are from Bérigny, op. cit., p 74.

23 Flachat, op. cit., vol. 2, p 186.

24 In 1760 and 1765 an engineer, Sieur Passement, proposed a canal to bring sea-going ships up to Poissy, and in 1768-69 a Captain Bertholot in fact made four voyages from LeHavre to Paris in a ship of 160 tons, the St.-Ouen; J.J. leF. de Lalande, Des canaux de navigation et spécialement du Canal de Languedoc, (Paris 1778), para. 386.

25 Bertrand Gille, Le Conseil général des Manufactures (inventaire analytique des procès-verbaux) 1810-1829, (Paris 1961), sessions of 12 March and 9 April 1818.

26 Ministère des Travaux Publics, Direction général des Ponts et Chaussées et des Chemins de fer, Documents statistiques sur les routes et ponts, (Paris 1873).

27 Anthiaume, op. cit., p 126.

28 In 1830 ice piled up to a depth of 7 to 15 feet at some places on the tow path between Rouen and Paris. In 1838 ice at Rouen stopped all navigation for five weeks during January and February; this was an unusually bad winter. Archives départementales de la Seine Maritime, Series S, Navigation de la Seine, affaires diverses. (G - Pg).

29 Ch. Collignon, Du concours des canaux et des chemins de fer et de l'achèvement du canal de la Marne au Rhin, (Paris 1845), p 70.

30 Bérigny, op. cit., p 75.

31 J.-D.-A. Coic et Duleau, Reconnaisances de la Seine de Rouen à Saint-Denis, en 1829 et 1830; et travaux proposés pour rendre cette partie de la Seine facilement navigable, (Paris 1830), pp 14-16.

32 Lalande, op. cit.; and Arch. Nat. F14.544, "Mémoire sur la navigation de la Rivière de Seine, où on Expose les difficultés que cette navigation éprouve et la nécessité d'y apporter un prompt Remède", (n.p. n.d.), written some time between 1768 and 1774, by someone obviously well acquainted with the Seine, probably an engineer.

33 Lalande, op. cit., p 424.

34 Flachet, op. cit., vol. 2, p 57. According to Dardel, op. cit., p 505, these had been in use in the eighteenth century.

35 Flachet, op. cit., vol. 2, p 58.

36 Procès-verbaux de la Chambres des Deputés, 1834, vol. 6, annexe 179, p 528, "Tableaux à joindre au Rapport fait au nom de la Commission ... projet de loi...navigation sur la Basse-Seine...."

37 Département de la Seine, op. cit., vol. 2, table 10, chapter 1.

38 Flachet, op. cit., vol. 2 p 60.

39 Le Moniteur de la Marine, 3 October 1858.

40 Vignon, Etudes historiques sur l'Administration des Voies Publiques en France au 17e siècle, (Paris 1862), vol. 1, p 22.

41 Ibid., p 24.

42 Préteux, "Les transports par terre et les Messageries au Havre", Receuil de l'Association des Amis du Vieux Havre, vol. 8(1929), pp 6, and 12-13.

43 These figures are taken from a speech by Charles Dupin in the Chambre de Deputés, on 15 June 1829; Le Moniteur Universel, 17.VI.1829, p 1038.

44 Rapport au Roi, 10 Mai 1829. Le Moniteur Universel, 16.V.1829, p 751.

45 Ministère de l'Intérieur. Administration général des Ponts et Chaussées et des Mines, Statistiques des Routes Royales de France, 1824, (Paris 1824); Ministère des Travaux Publics, de l'Agriculture, et du Commerce, Statistiques des routes royales de France, (Paris 1837).

46 Journal du Havre, 9 January 1827, article entitled "Canalization de la Seine."

47 An article signed J.B. in the Journal de l'industriel et du capitaliste, vol. 3(1837), p 41.

48 Schwilgué, "Mémoire sur les routes et sur le roulage", Annales des Ponts et Chaussées, (1832.2), p 216.

49 J. Levainville, Rouen, étude d'une agglomération urbaine, (Paris 1913), p 100.

50 The Corps des Ponts et Chaussées was organized in the eighteenth century as a skilled body of professional engineers, the first of its kind in Europe. From their work emerged the first scientific road-building techniques, set out in Trésaguet's "Construction et entretien des chemins" of 1775 (published in the Annales des Ponts et Chaussées, 1831.2), which inspired the later ideas of Telford and MacAdam. The corvée was a very rudimentary means of road-making; the labour was casual and unskilled, and supervision was loose. By the late 1770s the corvée en nature had been replaced by a money payment in most of the généralité of Rouen, and its replacement was being actively considered for the remaining pays d'élection. It was entirely abolished by an arrêté of 1786. See Vignon, op. cit., vol. 3, pp 135 & 179, and Letaconnoux, "Les voies de commerce en France au XVIIIe siècle," Vierteljahrschrift für Sozial- und Wirtschaftsgeschichte, (1909).

51 Arch. Nat. Fl4.1964; 'Extraits du mémoire de Duvergier, "Du Roulage en France depuis 60 ans, considéré comme moyen de comparer l'état ancien des grandes routes et leur état actuel"; 28 February 1828.

52 Circular of Directeur-général des Ponts et Chaussées Molé to Prefects, 29 June 1816, Receuil des circulaires, vol. 3, (1823), pp 71-79.

53 Berthault-Ducieux, Historique, situation et raison d'être du service d'expériences sur l'entretien des routes, (Paris 1845), p 15.

54 Schwilgué, op. cit., p 194.

55 This was Schwilgué's argument; ibid.

56 The legislation involved was a decree of 23 June 1806. Regulation of vehicle loads had begun early in the eighteenth century with an ordonnance of 1724; this limited the number of horses in a team used to pull 2-wheeled vehicles. With modifications of detail, this continued through the century. Inspired by English example, an arrêté of 1783 allowed teams of unlimited size to be used for vehicles with wheel rims larger than Om.14. This was the beginning of a new method of regulation. The next step was taken in 1802 with the establishment of "ponts à bascule", of road-side vehicle scales, and in 1806 a schedule of weight limits, graduated according to rim-sizes was prescribed. A good summary of the history of vehicle regulations up to the 1840s is contained in Emmery, "Recherches sur les principes qui paraissent devoir former la base d'une nouvelle législation pour la police du roulage", Annales des Ponts et Chaussées (1841.2), pp 257-266.

57 Arch. Nat. Fl4.1964, op. cit., tables 1-6.

58 A good description of roulage accéléré is contained in P.-E. Teisserenc de Bort, Statistique des voies de communication en France, (Paris 1845), p 7.

59 Schwilgué, op. cit., p 222.

60 Ibid., pp 237-8. These figures were gathered by Schwilgué from the operations of wagons between Rouen and Paris, in about 1828.

61 P. Barrey, "LeHavre maritime, la batellerie et les transports par terre du XVIe au XIXe siècle", Mémoires et documents J. Hayem, vol. VI(1921), p 124.

62 Archives de la Ville du Havre, F2.4, Liasse 12; a printed circular dated 15 February 1817 by a newly formed company, Duport et Belliscer jeune of Paris. They operated roulage accéléré to the Loire, Brittany, Poitou and Bordeaux, and seem also to have had some business in LeHavre.

63 Ibid., a printed circular dated Paris, 24 October 1818.

64 Observations préliminaires, La Statistique des Routes Royales de France, (Paris 1824).

65 Flachat, op. cit., vol. 2, p 177.

66 Ibid., p 252.

67 Flachat, op. cit., vol. 2, p 252.

68 The opportunity cost of longer transport would have been almost 2 F per ton; storage in the entrepôt de Bercy, which averaged 20 weeks, at 15 centimes per ton per week, would have cost a further 10 F (including the opportunity cost of time in storage). Data from Flachat, op. cit., vol. 2 pp 252 and 264.

69 Ibid., p 290.

70 Département de la Seine, op. cit., vol. 4; table 8.

71 Flachat, op. cit., vol. 4, p 230.

72 Arch. Nat. F14.1964, op. cit.

73 Schwilgué, op. cit., p 244.

74 Ministère de l'Intérieur, Rapport au Roi sur la navigation intérieure de la France, (Paris 1820).

1 Marcel Marion, Histoire financière de la France depuis 1715, (Paris, 1914-31), vol. 5, pp 4-8.

2 J. Letaconnoux, "Les voies de commerce en France au XVIIIe siècle," Vierteljahrschrift für Sozial- und Wirtschaftsgeschichte, (1909), p 130.

3 Louis Becquey (1760-1849), a moderate royalist deputy in 1791 and 1792 and during the Restoration; he resigned in 1830 in protest against what he considered to be the excessively liberal policies of Martignac. See Beugnot, Vie de Becquey, (Paris 1852). His predecessors during the interim from 1815 to 1817 were the baron Pasquier and comte Molé; the latter had held the same position from 1809 to 1813.

An excellent history of the Administration des Ponts et Chaussées during the Ancien Régime and the Empire is Jean Petot's Histoire de l'Administration des Ponts et Chaussées, 1599-1815, (Paris, 1958). The Ponts et Chaussées existed on two levels. There were the central bureaux, organized at this time into four divisions (personnel and secretariat, navigation intérieure, mines, and compabilité) under 15 chefs and sous-chefs de bureaux, with a total personnel of about 60. (See Almanach Royal, 1847; Petot says, p 422, that in the Year X there were 55 employees in the central bureaux.) The substantive work of the Ponts et Chaussées was done by its large corps of engineers. At their centre was the prestigious Conseil-général des Ponts et Chaussées whose task was to review all projects and to advise the Directeur-général and the Minister on technical and economic matters. On the council sat six inspecteurs-généraux, and as the amount of business dealt with grew over the next several decades, their number was considerably augmented. Beneath this council and advising it were the engineers of the Corps des Ponts et Chaussées, directed in each department by an ingénieur-en-chef. The total professional personnel of all grades at this time was about 550. Alphonse Debaube, in Les Travaux publics et les ingénieurs des Ponts et chaussées depuis le XVIIe siècle, (Paris 1893), p 357, says there were 549 in 1807 and that by 1890 this number had grown to 686.

4 Ministère de l'Intérieur, Rapport au Roi sur la navigation intérieure de la France, (Paris, 16 August 1820).

5 See Ernest Grangez, Précis historique et statistique des voies navigables de la France et d'une partie de la Belgique. (Paris 1855), pp 739-746.

6 Joseph Dutens, Histoire de la Navigation intérieure de la France, (Paris 1829), vol. 2, p 238.

7 The substance of these reports is contained in Charles Bérigny, Navigation maritime du Havre à Paris, (Paris, March 1826).

8 An exposé of this project is given by its author, with a brief account of previous projects for the same purpose in Frissard, Navigation fluviale du Havre à Paris. Amélioration de la navigation du Havre à Rouen, (LeHavre 1832).

9 Arch. Nat., Fl4.6813, "Résumé du Chapitre 2 du rapport général de l'ingénieur-en-chef Directeur du Département du Seine-et-Oise, sur l'amélioration de la navigation de la Seine," 15 November 1824.

10 A full description of this project, and the reasons why it was abandoned, are given in J.J. le F. de Lalande, Des canaux de navigation et spécialement du Canal de Languedoc, (Paris 1778), pp 386-390.

11 Marivetz et Goussier, Système général, physique et économique des navigations naturelles et artificielles de l'intérieur de la France, et de leur co-ordination avec les routes de terre, (Paris 1788), p 165.

12 Arch. Nat., Fl4.708.1, Canal de Paris à Rouen, 1698 - An XIII, municipalité de Paris.

13 Ibid., projet du Sieur Isnard.

14 Archives de la Ville du Havre, 03.3; Lesueur...à ses concitoyens, 11 Vendémiaire An IX; J.-B.-D. Lesueur, Recherches sur la navigation de la Seine, depuis la mer jusqu'à Paris, (Paris 1876).

15 Bertrand Gille, Le Conseil général des Manufactures (inventaire analytique des procès-verbaux), 1810-1829, (Paris 1961), pp 74-93; sessions of 12.III.1818, 9.IV.1818, 31.VIII.1819.

16 If one discounts these savings to their present value in the year of construction, as is the present-day practice, even with a discount rate of only one per cent per year, it would be more than 100 years before accumulated savings equalled original capital costs. This takes no maintenance or operating costs into account.

17 Bérigny, op. cit., p 26.

18 Ministère de l'Intérieur, Rapport, op. cit., p 3.

19 Minard, "Notions élémentaires d'économie politique appliquées aux travaux publics," Annales des Ponts et Chaussées (1850.2), p 30

20 Charles Dupin, Voyages dans la Grande Bretagne, 3e partie, (Paris 1824), p 161.

21 Ibid., p 84

22 Michel Chevalier, "Statistique des travaux publics, sous la monarchie de 1830," Journal des Economistes, vol. 21 (1838), p 282

23 Letaconnoux, op. cit. (1909), p 114.

24 On his return he wrote Mémoires sur les travaux publics d'Angleterre, (Paris 1819). Baron Charles Dupin also travelled to England on many occasions, and in his Voyages, op. cit., p 87, he outlined in detail the method by which local 'capitalists' could be induced to contribute toward the financing of public works in their area.

25 Charles Dupin, Forces productives et Commerciales de la France, (Paris 1827), vol. 2, p 297.

26 Arch. Nat. Fl4.7106, Mémoire from S. Flachat and Pirault de Chaumes to the Prince de Polignac, 24 October 1824.

27 Arch. Nat., Fl4.7106, letter to Minister of Finance, January 1825.

28 Arch. Nat., Fl2.2615G, Ordonnance Royale of 16 February 1825.

29 Arch. Nat. Fl4.7106, letter from company to Directeur-général des Ponts et Chaussées, 19 March 1825.

30 Maurice Lévy-Leboyer, Les banques européennes et l'industrialisation internationale dans la première moitié du XIXe siècle, (Paris 1964), pp 272n34 and 486n23.

31 Bertrand Gille, La banque et le crédit en France, 1815 à 1848, (Paris 1959), p 204.

32 Ibid., p 432n67.

33 Lévy-Leboyer, op. cit., p 480n2.

34 This report is mentioned in Arch. Nat. Fl4.7106, "Exposé général des verifications et des examens relatifs aux travaux d'art prescrits par le Conseil-Directeur en exécution de l'ordonnance royale du 16 fevrier 1825," 14 April 1828.

35 Ibid., referred to in "Commission des Canaux. Avis...pour faire suite au rapport de M. Brisson en date du 4 Août 1828. Paris le 2 janvier 1829."

36 Ibid., "Exposé général....", 14 April 1828.

37 Partiot, Etude sur les rivières à marée et sur les estuaires, (Paris 1892), p 27; the original work was by J.-E. Lamblardie, Mémoires sur les Côtes de la Haute-Normandie..., (LeHavre 1789).

38 Thomas, "Du commerce maritime de la place de Rouen," Revue de Rouen, vol. 4 (1834), p 59.

39 In Lamblardie, Canal Maritime de Paris au Havre. Observations sur un mémoire de M. Pattu, (Paris 1826).

40 S. Flachat, Du Canal maritime de Rouen à Paris et des perfectionnements de la navigation intérieure..., (Paris 1829), p xx.

- 41 In a manuscript of March 1826 cited by the Baron de Prony in "Examen relatif aux projets de barrage de la Seine dans le voisinage du Havre," Annales des Ponts et Chaussées (1831.1).
- 42 Le Moniteur Universel, 30 May 1826, p 826.
- 43 Arch. Nat. Fl4.7106, "Exposé général...", 14 April 1828.
- 44 Already Drouillard had left the company early in 1827, and had later been joined by two others, one of them Adolphe Thibaudeau, in asking that a limit be set on the time allowed for the company's studies. Arch. Nat. Fl4.7105, letter to Directeur-général des Ponts et Chaussées, 18 March 1827. Thibaudeau was later to be secretary of the Paris-to-Rouen Railway Co; the third signature on the letter is illegible.
- 45 Ibid., "Commission des Canaux. Avis.... 2 janvier 1829."
- 46 Lamé, Clapeyron, S. et E. Flachat, Vues politiques et pratiques sur les travaux publics de France, (Paris Sept. 1832), p 127, note by S. Flachat.
- 47 Ernest Grangez, Discussion et documents sur les canaux, sur les routes et sur les chemins de fer de la France, (Paris 1830), p 161.
- 48 Flachat, op. cit., p xlviii.
- 49 Ministère de l'Intérieur, Rapport sur la situation des canaux au 31 mars 1828, (Paris 1828).
- 50 Archives de la Ville du Havre, 02.1, Le Ch^{er} Saugnier to the mayor of LeHavre, 8.vI. 1828.
- 51 Bulletin des Lois, ser 8, vol 1(1824), pp 49 and 57, describes briefly two patents granted to Sargent and Hodgkin for the importation and manufacture of bricks and tiles and other pottery.
- 52 Bulletin des Lois, ser 8, vol 3(1825), p 76.
- 53 Cited in J.-A. Durbec, "Contribution à l'histoire du chemin de fer de Paris à la mer: Paris-Rouen-LeHavre (1825-1843)," 81e Congres des Sociétés Savantes, Rouen-Caen, 1956, Section Histoire moderne et contemporaine, p 648.
- 54 In Navier, De l'établissement d'un chemin de fer entre Paris et Rouen, (Paris 1826), p 1.
- 55 Ibid., p 3.
- 56 Ibid., p 7; these estimates made use of one of the best contemporary authorities, Thomas Tredgold's Practical Treatise on Railroads and Carriages, (London 1825).
- 57 Durbec, op. cit., p 644.
- 58 Archives de la Chambre de Commerce et d'Industrie du Havre, Liasse 21, letter from CC Havre to Prefect of Seine-Inférieure, 22 March 1825.

59 Archives départementales de la Seine-Maritime, IS/10.1, Memoire of the CC Rouen, 15 April 1825.

60 Fourier, "Note sur les effets utiles qu'on peut obtenir d'un cheval, à différentes vitesses, pendant une journée de travail, sur les routes ordinaires, les chemins de fer et les canaux," Annales des Ponts et Chaussées, (1836.1), pp 90-99.

61 The average speed of flow of the current in the Seine was about 3.5 kph, and the usual speed of towing was about 2 kph; C.-J. Minard, Cours de construction des ouvrages qui établissent la navigation des rivières et des canaux, (Paris 1841), p 52. This gives a total velocity of 5.5 kph, at which the ratio of pulling capacity for horses, according to the tables of Fourier, op. cit., is 466 (for waterways) to 263 (for railways).

62 Booth, "Chemin de fer de Liverpool à Manchester. Notice historique...", Annales des Ponts et Chaussées (1831.1), p 55.

63 Ibid., p 63.

64 Journal du Havre, 9 January 1827, article entitled "Canalisation de la Seine."

65 G. Lefranc, "The French Railroads, 1823-1842", The Journal of Economic and Business History, vol 2 (1929-31), p 314.

66 Arch. Nat. F14.7106, "No.1, Mémoire sur le Canal Maritime de la Seine de Paris à Rouen", 27 May 1829.

67 Arch. Nat. F14.7106, letter from Flachat (signing in the names of 20 others in the company) to Directeur-général des Ponts et Chaussées, 25 June 1829.

68 Flachat, op. cit., vol 4, pp 35-38.

69 Arch. Nat. F14.7106, "Rapport à la Commission des canaux, sur le projet d'un Canal Maritime de Paris à Rouen", by Cavenne, 6 August 1829, accepted by the Commission 22 August 1829; it was then debated in the full Conseil-général des Ponts et Chaussées in sessions of 25 August 1829, 9, 16, 23 January and 12 February 1830.

70 Flachat, op. cit., vol 4, pp 88-89.

71 Arch. Nat. F14.7106, Circular letter from the Directeur-général des Ponts et Chaussées, 6 January 1830, requesting the Prefects of the Seine, Seine-et-Oise, Eure, and Seine-Inférieure to consult commissions of inquiry, Chambres of Commerce and municipal councils; the Chambres of Commerce in Strasbourg, Calais and Boulogne were also consulted:

72 Observations de la Chambre de Commerce de Rouen, sur le projet de canal maritime de Rouen à Paris, 16 avril 1830, (Rouen 1830).

73 Opinion de la Chambre de Commerce du Havre, sur l'entrepôt de Paris, (LeHavre 1830).

74 Arch. Nat. F14.7105, letter from company to President of Council of Ministers, 4 March 1830.

75 Arch. Nat. F12.2615G, letter from company (signed S. Flachat, Blaisot, Fessart) to comte Beugnot, 4 June 1830.

76 Arch. Nat. F12.2615G, "N0. 2bis", (appendix to Report of M. Mollard) and "N0. 3, 3e séance" of Bureau de Commerce.

77 Gille, op. cit. (1959), p 324.

78 Lévy-Leboyer, op. cit., p 485.

79 Lamé, Clapeyron, S. and E. Flachat, op. cit., p 324.

80 Arch. Nat. F14.7106, letter from Section de la Navigation Intérieure to Tarbé, inspecteur-général, 3 November 1831.

81 Arch. Nat. F14.7106, "Canal Maritime de la Seine de Paris à Rouen. Projet de Barrages. Extrait des registres du Conseil-général des Ponts et Chaussées", Annexe and session of 16 April 1832.

82 Examples on the side of railways were the pamphlet on a railway from Paris to LeHavre by Navier, cited above; a thorough treatment of the subject by Joseph Cordier (député and inspecteur-divisionnaire des ponts et chaussées), in Considérations sur les chemins de fer, (Paris 1830); the comprehensive work by Lamé, Clapeyron, S. and E. Flachat, cited above; a less important work by J. de Baader, Sur l'avantage de Substituer des Chemins de fer d'une construction améliorée à plusieurs canaux navigables projetés en France, (Paris 1829); and the several articles in the Annales des Ponts et Chaussées cited below. A notable example on the side of water-borne transport was Ernest Grangez (later chief of the Section de la Navigation in the Administration des Ponts et Chaussées), Discussion et documents sur les canaux, sur les routes et sur les chemins de fer de la France, (Paris 1830).

83 Arch. Nat. F14.7106, "Extrait des registres du Conseil-général des Ponts et Chaussées", session 8 May 1832.

84 J.-D.-A. Coic and Duleau, Reconnaissances de la Seine de Rouen à St. Denis, en 1829 et 1830; et travaux proposés pour rendre cette partie de la Seine facilement navigable, (Paris 1830).

85 Arch. Nat. F14.7106, op. cit., session 2 April 1832.

86 C.-J. Minard, "Notions élémentaires d'économie politique appliqués aux travaux publics", Annales des Ponts et Chaussées, (1850.2), pp 1-125. Although written in 1831 this course, which had the approval of J.-B. Say, was not taught until 1847; it was probably known amongst Minard's senior colleagues from a much earlier date. For an interesting short history of "cost-benefit analysis", in which it is stated that its beginnings were in early 19th century France, see A.R. Prest and R. Turvey, "Cost-benefit analysis: A Survey", in Surveys of Economic Theory, vol 3, (London 1966).

87 Of the "Lancashire Witch" type, used on the Bolton and Leigh Railway; they weighed 10.6 tons and generated about 10 hp; see Robert Stephenson and Joseph Locke, "Comparaison des machines et des machines locomotives...", Annales des Ponts et Chaussées, (1831.1), p 272.

88 J. Lobet, Des chemins de fer en France et des différents principes appliqués à leur tracé, à leur construction et à leur exploitation, (Paris 1845), p 73.

89 Walker et Rastrick, "Mouvements commerciaux sur les chemins de fer. Extrait d'un rapport ...publié avec notes," Annales des Ponts et Chaussées, (1831.1), pp 230-256.

90 Ibid., p 247.

91 L. Coste et A.A. Perdonnet, Mémoire sur les chemins à ornières, (Paris 1830), first published in the Annales des Mines, 1829.

92 Ibid., p 185.

93 Booth, op. cit., p 70.

94 Lobet, op. cit., p 75.

95 The priority of invention of the multitubular boiler is disputed between G. Stephenson and M. Séguin. Samuel Smiles, in his Lives of the Engineers, vol 3, biography of George Stephenson, p 281, attributes it to Stephenson, but mentions Séguin, pp 279-81. The "Lancashire Witch" locomotives sent to Lyon and Arras in 1829 had tubular boilers, but it was the water, not the fire, which circulated in the tubes, and this was found to be quite unsatisfactory. According to Lobet, op. cit., p 73, Séguin had been working on a tubular boiler of his own since 1827, and on 22 February 1828 the Sieurs Séguin et Cie. received a patent for a "chaudière à vapeur sur le principe de l'air chaud circulant dans les tuyaux isolés de petite dimension", (Bulletin des Lois, ser 8, vol 8, p 514). This antedates the "Lancashire Witch" arrivals in France, and considerably antedates the building of the "Rocket", the first locomotive of G. Stephenson to use hot-air circulating in a multitubular boiler. If not conclusive, Séguin's claim to priority is certainly very convincing. Another French author, F.M.G. de Pambour, in Traité théorique et pratique des Machines locomotives, (Paris 1835), p 7n argues convincingly for Séguin's claim.

96 Booth, op. cit., p 70.

97 Stephenson and Locke, op. cit., p 273.

98 Annales des Ponts et Chaussées, (1832.2), p 124.

99 Lamé et al., op. cit., p 127n.

100 Arch. Nat. F14.7106, letter from Directeur-général des Ponts et Chaussées to the Minister of Commerce and Public Works, 29 October 1831.

101 Arch. Nat., F14.8862, "Mémoire à l'appui d'un projet de Chemin de fer de Paris à Rouen", 20 April 1832, by Ardoin et Cie; a cahier des charges was submitted by Mellet, Henry et Ruolz on 15 October 1831 and approved by the Minister of Public Works on the same day. See also Durbec, op. cit. Mellet, Henry, Ruolz et Cie, which proposed to build a railway to Rouen across the plateau north of the Seine valley, was financed by baron Charles Davillier and other bankers in Paris, Henry Barbet, mayor of Rouen, and Reizet, receveur-général des finances for the Seine-Inférieure. Arch. Nat., F14.8862, Mellet, Henry et Cie to the Directeur-général des Ponts et Chaussées, 23.V.1833.

102 Le Moniteur Universel, 22.VIII.1832, p 1614, and Arch. Nat., F14.8862, Report to the Prefect of the Seine-Inférieure by the Commission of Inquiry, 13.XI.1832.

103 Lamé et al., op. cit.; contains a letter from the canal company dated August 1832, p 323f.

104 One of the two railway companies mentioned above, the Cie Ardoin, which proposed to build a line from Paris to St.-Denis and later to Rouen, via the valley of the Seine, was headed by Charles Ardoin and by Riant, a Paris iron merchant; before 1830 Ardoin had been one of the main organizers of financial support for the maritime canal company.

1 In 1803 the American inventor Robert Fulton demonstrated a steamboat to a delegation of the Académie des Sciences on the Seine east of Paris and it did 6 kph. B. Nogaro and W. Oualid, L'évolution du commerce, du crédit et des transports depuis cent cinquante ans, (Paris 1914), p 175; Roger Pilkington, "Canals: Inland Waterways outside Britain", in A History of Technology, eds. Singer et al., (London 1958), vol 4, p 548. There is a summary of the early history of steam in river transport with particular reference to France, in the excellent volume by Félix Rivet, La Navigation à vapeur sur la Saône et le Rhône (1783-1863), (Paris 1962), pp 50ff.

2 Charles Brisson, "'Pompes à feu' et 'Batteaux à Vapeur' à Elbeuf sous Louis XVIII," Annales de Normandie, vol 8 (1958), pp 293-305.

3 Felix Libaudière, Histoire de Nantes sous le règne de Louis-Philippe, 1830-1848, (Nantes 1900), p 12; Rivet, op. cit., p 69.

4 The patent, of 26 August 1819, was for "un bateau mécanique portant un manège qui imprime le mouvement de rotation à une roue à aubes"; it was sold to Magendie et Cie on 8 April 1820. Ministère de l'Intérieur, Catalogue des spécifications de tous les principes moyens et procédés pour lesquels il a été pris des brevets..., (Paris 1826), p 254.

5 In 1822 this company obtained limited liability with the status of société anonyme; Acte de société of 4-5 March 1822, "Société Anonyme des transports accélérés par eau," Bulletin des Lois, sér. 7, vol 15(1822), p 188f.

6 See Jean Vidalenc, "Quelques remarques sur le rôle des Anglais dans la révolution industrielle en France, particulièrement en Normandie, de 1750 à 1850." Annales de Normandie, vol 8(1958), pp 273-90.

7 Maurice Lévy-Leboyer, Les banques européennes et l'industrialisation internationale dans la première moitié du XIXe siècle (Paris 1964), p 363.

8 W.H. Chaloner and W.O. Henderson, "Aaron Manby, Builder of the First Iron Steamship", Transactions of the Newcomer Society, vol 29(1953-54 and 1954-55), p 79.

9 Arch. Nat. Fl2.6764, "Société anonyme des bateaux à vapeur sur la Seine."

10 Louis Brindeau, Les premiers bateaux à vapeur au Havre, (LeHavre 1901), p 11.

The role of Paris in providing funds for these companies, all of which seem to have been financed by an issue of shares, was very prominent. All twenty-seven shareholders in the Compagnie Magendie gave Paris as their place of residence. Twenty-five out of twenty-nine of the shareholders in the Compagnie Reynaud, when it obtained the status of société anonyme in 1827, were also residents of Paris. Of the third company

nothing is known. One can break down the two lists of shareholders by occupations; for the Cie Magendie there were four in the legal profession, three military, two négociants, two officials, and one banker, rentier, saddler, and employé. In the Cie Reynaud there was equal variety: two peers, two professionals, one local official, then four high court officers, five bankers, five military and six propriétaires. Bulletin des Lois, ser 7, Vol 15(1822), p 188f, and Ibid., ser 8, Vol 204bis(1827), p 5ff.

11 Bertrand Gille, La banque et le crédit en France de 1815 à 1848, (Paris 1959), p 301.

12 S. Flachat, Du Canal Maritime de Paris à Rouen, (Paris December 1829), Vol 2, pp 71-78.

13 These voyage times and rates are taken from Flachat, op. cit.; Bérigny, Navigation maritime du Havre à Paris, (Paris 1826), p 75; Schwilgué, "Mémoire sur les routes et sur le roulage", Annales des Ponts et Chaussées, (1832.2), pp 189-249; and Arch. Nat. Fl2.6764, "Cie des Bateaux à vapeur en fer sur la Seine".

14 Tourasse and F.N. Mellet, Essai sur les bateaux à vapeur..., (Paris 1828-29), p 107.

15 Chaloner and Henderson, op. cit., p 81.

16 Arch. Nat. Fl2.6764, printed pamphlet, Observations de M. Napier sur l'entreprise des Bateaux à Vapeur en fer adressées à MM. les actionnaires, (Paris 27 January 1827).

17 Arch. de la ville du Havre, F2.4, L.13, letter Minister of Commerce to Prefect of Seine-Inférieure, 6 August 1831.

18 Chaloner and Henderson, op.cit., p 88.

19 Flachat, op. cit., pp 99-100.

20 Ibid., p 78.

21 Ernest Grangez, Discussion et documents sur les canaux, sur les routes et sur les chemins de fer de la France, (Paris 1830), p 75.

22 Tourasse et Mellet, op. cit., p 218.

23 Ibid., pp 217, 219; Bulletin des Lois, ser 7, Vol 15(1822), p 189.

24 Arch. de la Chambre de Commerce et d'Industrie de Havre, (ACCIH) Liasse 19, CC Havre to Minister of the Interior, 28 September (1825).

25 Tourasse and Mellet, op. cit., p 217.

26 Ibid., p 213.

27 These figures were obtained from the weekly lists of arrivals and departures of ships in the Journal du Havre, 1826.

28 Tourasse and Mellet, op. cit., p 213.

29 Journal du Havre, 2 March, 9 May and 18 June 1827.

30 Chaloner and Henderson, op. cit., p 80.

31 Arch. Nat. F12.6764, "Cie des Bateaux à vapeur en fer sur la Seine", "Inventaire du Matériel des Bateaux à vapeur en fer L'Aaron Manby et Le Commerce de Paris (26 Juillet 1825)".

32 Arch. Nat. F12.6764, "Cie des Bateaux à vapeur en fer sur la Seine".

33 The calculations of the Bureau de Commerce showed that the annual net revenue from 14 voyages by one steamer between LeHavre and Paris was 41,465 F. The annual fixed costs, including 5% interest, for one steamer valued at 250,000 F, were 39,000 F. This left enough for a dividend of 2,465 F, or one per cent.

34 The basis for this estimate is as follows: The actual costs of the steamer service between LeHavre and Paris were:

Direct costs per voyage (15 per year):

crew	850 F
fuel	2,000
general costs	1,900
insurance	650

Indirect costs per boat per year:

administration	5,000 F;	per voyage	334 F
repairs	6,000	"	400
interest @ 6%	13,700	"	910

Total costs per voyage 7,044 F

The four boats also did about eight voyages per year between LeHavre and Rouen; however, in the company accounts all indivisible costs were imputed to the Paris-LeHavre voyages. This seems to have been poor practise, since owing to close competition from other forms of transport the price-elasticity of demand for steam transport was high; for this reason the rate on these voyages should have been kept as low as possible by imputing some of the indivisible costs to the LeHavre-Rouen voyages. The main point here though is that if the voyage time between Rouen and Paris could have been halved, from five to two and a half days, reducing total voyage time to 15½ days from 18 days, then 18 instead of 15 voyages per year could have been made. This would give the following costs per voyage:

Direct costs per voyage (18 per year):

crew	710 F
fuel	1,250
general costs	1,580
insurance	650

Indirect costs per boat per year:

administration	5,000 F;	per voyage	280 F
repairs	6,000.	"	334
interest @ 6%	13,700.	"	765
Total costs per voyage		5,569 F	

If the same loads were maintained on these voyages, ie 116 tons LeHavre-Paris, then the rate from LeHavre to Paris could have been lowered to 45 F per ton (the actual rate was about 50 F) and Paris to LeHavre to 10.5 F (18 F); or alternatively while keeping the Paris to LeHavre rate at 18 F, the upstream rate could be lowered to 35 F. Keeping the rate between LeHavre and Rouen at 25 F the rate from Rouen to Paris could have been reduced to 20 F, or would have given the firm the same net revenue. All the above estimates are derived from accounts of the company, signed A. Manby, and verified by the Comité des Arts et Manufactures, Bureau de Commerce, signed 12 January 1826, Gay Lussac, and Gaillard Lousinville, Arch. Nat. Fl2.6764.

35 Weekly listings in the Journal du Havre, 1826.

36 Arch. Nat. Fl2.6764, Observations de M. Napier..., op. cit.

37 Varnier fils aîné, Replique de M. Varnier fils aîné, directeur au Havre de l'entreprise des bateaux à vapeur en fer pour refuter les assertions de M. Napier, (Paris n.d.).

38 Bulletin des Lois, sér. 8, 204 bis (1827), p 5.

39 Arch. Nat. Fl2.6764, "Inventaire... (26 Juillet 1825)". Many of the Cie Reynaud shareholders must have a considerable amount on their investment. Major-General E.H. Napier says that his father engaged in "various speculations, the most ruinous of which eventually proved to be that of establishing iron steam-boats on the Seine." E.H.D.E. Napier, Life and Correspondence of Admiral Sir Charles Napier, (London 1862), Vol 1, p 120, quoted in Chaloner and Henderson, op. cit., p 79.

40 Bulletin des Lois, ser 7, Vol 16(1823), p 41.

41 Journal du Havre, 17 January 1826.

42 Journal du Havre, 27 July 1826.

43 Journal du Havre, 9 January; 13, 29 March; 13 June 1827.

44 Tourasse and Mellet, op. cit., pp 110 and 218.

45 Its steamboats were ETNA (built 1824), 100 t., 40 hp.; ATALANTE (1825), 100 t., 40 hp.; AIGLE (1826), 80 t., 40 hp.; FOUDRE (1826), 160 t., 80 hp. Journal du Havre, 13 June 1827.

46 His advertisements appeared in the Journal du Havre.

47 Memorial de Rouen, 1840

48 Journal du Havre, 23 May 1827

49 Arch. départementales de la Seine-Maritime (ADSM), Series S, Navigation, Statistiques des bateaux à vapeur naviguant sur les fleuves (1834-1850).

50 Tourasse and Mellet, op. cit., p 215.

51 From the weekly listings in the Journal du Havre, 1827.

52 Tourasse and Mellet, op. cit., p 215

53 Ibid., p 214.

54 Journal du Havre, 3 July 1826

55 Navigation accélérée was not in principle a recent invention. According to Pierre Dardel, Navires et Marchandises dans les ports de Rouen et du Havre au XVIIIe siècle, (Paris 1963), p 511n1, the privilege of operating 'bateaux en diligence' was first granted in May 1674, and other boatmen were forbidden to use relays to run fixed-schedule services; the possessors of the privilege leased it to a company which operated the boats. The prohibition of relays for other operators was last renewed by an arrêt du conseil of the 4th of September 1783.

56 Journal du Havre, 29 November 1826.

57 ADSM, Series M, Commerce: Matières diverses.. Maire de Rouen to Prefect of Seine-Inférieure, March 1840.

58 Schwilgué, op. cit., p 224.

59 This table is taken from monthly figures for the years 1828 to 1831, in ADSM, Administration, Statistiques: commerce, industrie, enquêtes, 1820-37.

60 ADSM, Series S, Navigation de la Seine, compagnies de Transport accéléré de marchandises, Report from CC Rouen, 27 March 1829.

61 Bibliothèque de la Chambre de commerce de Rouen, "Projet d'amélioration de la Navigation de la Seine, entre Paris et Rouen", (Nevers 18 February 1836), signed Poirée.

62 Ibid.

63 P.-F. Frissard, Navigation fluviale du Havre à Paris. Amélioration de la navigation du Havre à Rouen, (LeHavre 1832), p 21.

64 Schwilgué, op. cit., p 224

65 ADSM, Series S, Navigation de la Seine, compagnies de Transport accéléré de marchandises, letter of CC Havre to Minister of the Interior, 3 February 1829.

66 Arch. Nat. F14.8862, "Rapport à la Chambre de Commerce de Paris, le 22 juin 1831."

67 Arch. Nat. F14.6813, "Mémoire sur les moyens de perfectionner la navigation de la Seine entre Paris et Rouen...", Charles Bérigny, 20 January 1834.

68 Arch. Nat. F14.6814, "Note", by Michal, 27 May 1853.

69 See Pierre Dardel, Commerce, Industrie et Navigation à Rouen et au Havre au XVIIIe siècle. Rivalité croissante entre ces deux ports. La conjoncture, (Rouen, Société libre d'émulation de la Seine Maritime, limited publication, 1966), passim.

70 Descriptions of the several attempts to establish this tug-boat service are given in A. LeCorbeiller, Histoire du Port de Rouen et de son Commerce, (Rouen 1902), pp 138 f, and in H. Wallon, Le Magasin de Sauvetage de Quillebeuf et les services qu'il a rendu à la navigation de la Seine, (Rouen 1902), pp 209-58.

71 Jean Rondeaux, Sur le remorquage des navires à voiles par bateaux à vapeur dans la basse-Seine, (Rouen 1824).

72 This was the UNION of 80 hp, built in England, and provided by a group of "foreign" capitalists; Wallon, op. cit., p 216.

73 Letter from Rondeaux to the President of CC Rouen, 4 September 1826, quoted in LeCorbeiller, op. cit., p 148. This is the best account of this important questionnaire and its results.

74. The term "avarie grosse" is used in shipping insurance, and translates into English as "general average"; it is normally a method of apportioning loss of cargo, ship or freight through intentional damage to ship or sacrifice of cargo.

75 The octroi de navigation was established by the law of 30 floreal An X (20 May 1802), and the particular schedule of charges for the Seine basin established by an arrêté of 19 messidor An XI (8 July 1803). The Administration set the rates of toll upon advice from local commissions in each river basin. They were intended specifically to pay for improvements and maintenance in each river basin, and were set at a level which would pay their full cost. This system was the result of great concern about the poor condition of national communications after more than ten years of neglect; tolls had been established on main roads in 1797.

76 Tableau D, Annexe NO. 179, Procès-verbaux des séances de la Chambre des députés, Impressions, (1834), pp 528-29

77 A circular was sent out by the Directeur-général des Ponts et Chaussées, Becquey, on the 1st of April 1820; Arch. Nat. F12.7598, cited in a petition from mariners to the Minister of Commerce, of 7 March 1829.

78 "Exposé des motifs du projet de loi...sur la navigation," session of 6 April 1824, Procès-verbaux de la Chambre des députés, Impressions, Annexe N0. 7.

79 Ernest Grangez, Traité de la perception des droits de navigation et de péage sur les fleuves, rivières et canaux..., (Paris 1840), pp 6-7.

80 Arch. Nat. Fl4.6813, "Police de la Seine. Trématage," signed Dupin, April 1829.

81 See monthly figures for the years 1828 to 1831, in ADSM, 5M5, Administration, Statistiques: commerce, industrie, enquêtes, 1820-37.

82 Arch. Nat. Fl2.7598, Directeur-général des Ponts et Chaussées to Minister of Commerce, 17 October 1828, and Minister of Commerce to Directeur-général des Ponts et Chaussées, 22 October 1828. This new initiative resulted from identical mémoires sent by the Compagnie des Canaux de Paris to the Directeur-général des Ponts et Chaussées and Minister of Commerce at the beginning of October 1828.

83 Ibid., Cie des Canaux de Paris to Minister of Commerce, 2 June 1829.

84 Two copies have been found; one is signed by baron Charles Dupin for 127 négociants and mariniers of Compiègne, Soissons, Pons, Beaumont, Pontoise, Vernon, Mantes, Meulan, and Paris, "Police de la navigation, Trématage," n.d. March 1829, Arch. Nat. Fl4.6813. The other was signed by the petitioners, and sent to the Minister of Commerce on the 7th of March 1829; Arch. Nat. Fl2.7598.

85 Arch. Nat. Fl4.6813, cited in the petition signed by Dupin.

86 ADSM, Series S, Compagnies de transport accéléré de marchandises, CC Havre to the Minister of the Interior, 3 February 1829.

87 Ibid., Rapport par la Chambre de Commerce de Rouen, 27 March 1829.

88 Annales des Ponts et Chaussées, Lois et ordonnances, 1831, "Réglement concernant la navigation de la Basse Seine entre Paris Rouen," 5 March 1831, p 95.

89 Loc. cit.

90 Amongst the protesters was André Bord de la Hauterive, De la grosse et de la petite marine en rivière de Seine entre Rouen et Paris, (Paris 1832),

91 Procès-verbaux de la Chambre de Commerce du Havre, (P.-v.CCH) 7 December 1832 and 19 December 1832.

92 Arch. Nat. Fl2.2516A, Petition to the Minister of Commerce and Public Works, 21 December 1832.

93 Arch. Nat. F12.2516A, Minister of Public Works to Directeur-général des Ponts et Chaussées, 17 January 1833.

94 Procès-verbaux...de la Chambre des députés, Impressions, Annexe N0. 47, 1834, session of 10 February 1834.

95 Ibid., Annexe N0. 195, 1836, session of 18 April 1836.

96 Ibid., Annexe N0. 179, 1834, Tableau D, pp 528-29. This estimate is derived from journey cost figures for bateaux-besognes by Charles Monier in De l'état actuel de la navigation de la Seine entre Paris et Rouen, et les moyens de la perfectionner, (Paris November 1832), pp 10-12.

97 The law of 23 May 1834 prescribed a rate, as recommended by the commission, of 2.5 centimes per ton per 5 kilometres upstream and 2.0 centimes downstream. Second-class goods were charged half and empty boats went free. The rate proposed by the Administration was 3 centimes per ton per 5 kilometres.

98 Ernest Grangez, op. cit., p 338.

99 The number of aides at Vernon was reduced, at the pertuis de la Morue increased. Chefs and aides at Bezons, Aisnieres, Neuilly and Sevres were replaced by simple garde ponts; "Reglement...", Ordonnance royale, 5 March 1831, Annales des Ponts et Chaussées, lois et ordonnances, 1831. Later in 1842 the chefs de passage at la Morue, Chatou and Croissy were also eliminated. Ord. Roy., 25 April 1842, Ibid., lois et ordonnances, 1842, pp 199-201.

100 The complete schedule of fees is contained in Grangez, op. cit., (1840), pp 354-56.

101 Poirée, ingénieur-en-chef, in his mémoire, "Projet d'amélioration de la Navigation de la Seine, entre Paris et Rouen," (Nevers, 1836), Bibliothèque de la Chambre de Commerce de Rouen, I-7-D²6.

102 There were pilots at LeHavre, at LaMailleraye (about 75) and until 1860 at Villequier (about 30); see Abbé Anthiaume, "Les pilotes havrais," Receuil de l'Association des Amis du Vieux Havre, N0. 9 (1929), pp 1-49, and Grangez, op. cit., p 360.

103 See for example, a mémoire sent to the Minister of Public Works early in 1833, PVCCH, 22 February 1833.

104 Bulletin des Lois, series 9, t.23, p 126, Ord. Roy. of 10 August 1841. The schedule was complex and fees varied with the tonnage and nationality of the ship or boat being towed; see also Grangez, op. cit., pp 358-60.

- 1 Maurice Jouffroy, L'Ere du Rail, (Paris 1954); p 84.
- 2 A.-A. Audiganne, Les chemins de fer aujourd'hui et dans cent ans chez tous les peuples, (Paris 1858-62), vol 1, pp 127& 135.
- 3 Arch. Nat. Fl4.8862, "Mémoire à l'appui d'un projet de chemin de fer de Paris à Rouen, par la Cie Soumissionnaire", 20.IV.1832.
- 4 Arch. Nat. Fl4.8862, Report of Ingénieur des Ponts et Chaussées to the Conseil-général des Ponts et Chaussées on project of Mellet, Henry et Cie, 10.XI.1832.
- 5 Procès-verbaux des séances de la Chambre des députés, Impressions, (1833), Annexe NO. 4, "Exposé des motifs et projet de loi sur les Travaux publics à continuer et à entreprendre", session of 29 April 1833, p 30.
- 6 "Note sur les chemins de fer, les canaux et les voies de terre," Annales des Ponts et Chaussées, (lois et ordonnances, 1832), pp 261-264.
- 7 From where he sent frequent reports, published in the Journal des Débats during 1833, and later as Lettres sur Amérique du Nord, (Paris 1836).
- 8 Ministère des Travaux Publics, Direction-général des Ponts et Chaussées, Situation des Travaux, (Paris 1834).
- 9 Arch. Nat. Fl4.8862, Conseil-général des Ponts et Chaussées (CGPC), extrait des registres, session of 29.VII.1850.
- 10 Arch. Nat. Fl4.8863, "Ponts et Chaussées, Département de la Seine-Inférieure, Chemin de fer de Paris à Rouen et au Havre, avec embranchements à Dieppe et à Pontoise," extract from report of Defontaine and Mallet.
- 11 Procès-verbaux des séances de la Chambre des députés, Impressions, (1833), Annexe NO. 4, op. cit., p 30.
- 12 Lamé, Clapeyron, E. et S. Flachet, Vues politiques et pratiques sur les travaux publics de France, (Paris, September 1832), p 15.
- 13 See G. Lefranc, "The French Railroads, 1823-1842," The Journal of Economic and Business History, vol 2, (1929-30), pp 299-331.
- 14 Le Moniteur Universel, 3.IV. 1835, p 723.
- 15 J.-A. Durbec, "Contribution à l'histoire du chemin de fer de Paris à la mer: Paris-Rouen-LeHavre (1825-1843)", 81e Congrès des Sociétés Savantes, Rouen-Caen, 1956, Section Histoire moderne et contemporaine, p 661.
- 16 Arch. Nat. Fl4.8863, "Extrait des Délibérations des Conseils Municipaux, des Chambres de Commerce des différentes Villes et des Commissions d'Enquête des Départements de l'Eure, de Seine-et-Oise, de la Seine-Inférieure et de la Seine. Chemin de fer de Paris à la mer par la vallée," n.d.

- 17 Arch. Nat. Fl4.8863, Cie Riant to Minister of the Interior, 29.I.36.
- 18 Procès-verbaux de la Chambre de Commerce du Havre (PVCCH), 20.V.1836.
- 19 Ibid., 6.XI. 1835.
- 20 Ibid., 18.III. 1836.
- 21 Archives de la Chambre de Commerce et d'Industrie de Havre (ACCIH), 21.CC Havre to Directeur-général des Ponts et Chaussées, 30.III.36, and Archives de la Ville du Havre, 02.1, liasse 1, Directeur-général des Ponts et Chaussées to Mayor of LeHavre, 11.IV.1836.
- 22 PVCCH, 20.V.1836.
- 23 Arch. Départementales de la Seine-Maritime (ADSM), Series S, Chemins de fer de l'Ouest, ligne de Paris à Rouen et au Havre, affaires générales, Enquête, session of 19.XI.1836.
- 24 A.-J.-C. Defontaine, Mémoire sur le projet d'un chemin de fer de Paris à Rouen au Havre et à Dieppe, (Paris 1837) p 2.
- 25 Arch. Nat. Fl4.8863, "Opinion de M. Devilliers", 3.IV.1837.
- 26 Arch. Nat. Fl4.8863, "Observation sur le projet de Chemin de fer de Paris au Havre...", Polonceau, 10.XI.1836.
- 27 Arch. Nat. Fl4.8863, Chambre of Commerce of Rouen, session of 25.XI.1836.
- 28 ADSM, Series S, chemins de fer de l'Ouest, ligne de Paris à Rouen et au Havre, affaires générales, "Enquête, Chemin de fer de Paris...au Havre," session of 19.XI.1836.
- 29 Ibid., Directeur-général des Ponts et Chaussées to Prefect of the Seine-Inférieure, 29.XI.1836.
- 30 Ibid., "Enquête...", session of 20.XI.1836.
- 31 Le Moniteur Universel, 9.V.1837, "Exposé des motifs et projet de loi...chemin de fer de Paris à Rouen", session of 8.V.1837, pp 118.
- 32 Arch. Nat. Fl4.8863, Defontaine to Directeur-général des Ponts et Chaussées, 31.I.1837.
- 33 ACCIH 21, Legrand to CC Havre, 16.V.1837.
- 34 Arch. Nat. Fl4*.10912.92, Conseil-général des Ponts et Chaussées, session of 16.III.1837.
- 35 Ibid., Conseil-général des Ponts et Chaussées, session of 27.II.1837.
- 36 Le Moniteur Universel, 9.V.1837, p1118.

37 ACCIH 21, CC Havre to Directeur-général des Ponts et Chaussées, 3.IV.1837. The Railway Times, 18.VII.1840, p 31. This rumour however, is also contradicted by another, perhaps less reliable source, a letter from the Société libre pour concourir aux progrès du commerce et de l'industrie de Rouen to the CC Havre on 10.III.1837, in ACCIH 21.

38 On the 16th of May 1837 there had been a letter published in the Moniteur Industriel from François Bartholony and Adrien Delahante, promoters then of a Nord railway project, and later involved in the "P-O (Paris-Orléans Railway) Group" of companies, offering to build lines from Paris to Lille and to LeHavre in several stages; this was a project they had been working on for about three years. It might have given slight hope to LeHavre, but Bartholony's scheme does not seem to have been taken seriously. For one thing, he wanted the government to guarantee interest of four per cent on the company's capital for 46 years; several governments, including the one in power, had already stated that this method of State assistance was unacceptable to them. See Bertrand Gille, Recherches sur la formation de la grande entreprise capitaliste (1815-48), (Paris 1959), pp 113ff.

39 Arch. Nat. F14.8863, Cie Riant to Minister of Public Works, 18.V.1837.

40 Ibid., Président de la Commission to Minister of Public Works, 23.V.1837.

41 Le Moniteur Universel, 5.VI.1837, p 1416.

42 Ibid., 17.VI.1837, p 1545f.

43 The prices of iron and coal had been rising through 1837 to quite high levels; see Maurice Lévy-Leboyer's Les Banques européennes et l'industrialisation internationale dans la première moitié du XIXe siècle, (Paris 1964), p 622.

44 ACCIH 21, LeMaistre to CC Havre, 25.V.1837.

45 Audiganne, op. cit., vol 1, p 162.

46 In November 1837, before the extra-parliamentary commission on railways, the Minister of Public Works stated without being contradicted that it was generally believed that no company could raise more than 50 MF on the Bourse. Procès-verbaux des séances de la Commission chargée d'examiner les questions que peuvent soulever les projets d'établissement des chemins de fer, (Paris 1837).

47 The Railway Times, 18.VII.1840, p 31.

48 Bertrand Gille, Histoire de la Maison Rothschild, vol 1, Des origines à 1848, (Geneva 1965), p 264.

49 Lévy-Leboyer, op. cit., p 263.

50 An example is the remark by Jaubert during the debate of 1837: "Je ne veux pas revenir au temps de Law et de la régence...." And he warned the deputies to take heed of what had happened elsewhere; "...l'orage s'approche, il faut serrer les voiles." Le Moniteur Universel, 17.VI.1837, p 1549. Concern among the financial community was expressed in a letter written by an official of the bank André et Cottier in May 1837 in which he said that "les entreprises de chemin de fer viennent un peu trop à la fois"; Gille, La banque et le crédit en France de 1815 à 1848, (Paris 1959), p 340. There had been a small investment boom, concentrated upon mining and gas lighting companies, since 1835, but it was precarious one, and threatened by financial crises in both North America and Great Britain; see Gille, op. cit., pp 332-340.

51 Lévy-Leboyer, op. cit., pp 618-619.

52 Le Moniteur Universel, p 1550.

53 Ibid., supplément B du 16.II.1838.

54 Procès-verbaux de la commission...des chemins de fer, op. cit.

55 Le Moniteur Universel, 28.II.1838, p 442.

56 Unfortunately there is no similar correspondence for Rouen, and the Archives of the Chambre de Commerce de Rouen and the Ville de Rouen have both been destroyed by fire. The correspondence for LeHavre is preserved in ACCIH liasse 21.

57 Chambre de Commerce du Havre et Conseil municipal de Havre, Mémoire relatif au chemin de fer de Paris à la mer et à Strasbourg, (LeHavre 1838).

58 ACCIH 21, Mermillod to CC Havre, 17.V.1838.

59 Ibid., Mermillod to CC Havre, 18.II.1838.

60 Ibid., Frissard to Oursel, 25.II.1838.

61 Ibid., Reilly to Balthazard, 22.II.1838.

62 Ibid., Frissard to Oursel, 13.III.1838.

63 Ibid., Frissard to Oursel, 25.II.1838.

64 Ibid., this appears on a piece of paper, covered with doodlings, evidently notes taken at one of the sessions of the commission mixte in LeHavre.

65 Ibid., Frissard to Oursel, 25.II.1838.

66 Ibid., Cie Riant to CC Havre, 20.II.1838.

67 Ibid., Frissard to Oursel, 26.II.1838.

68 Ibid., Frissard to Oursel, 16.III.1838.

- 69 Gille, Histoire de la Maison Rothschild, vol 1, p 268.
- 70 ACCIH 21, LeMaistre to Reilly, 19.III.1838.
- 71 Ibid., Frissard to Oursel, 16.III.1838.
- 72 Ibid., Frissard to Oursel, 19.III.1838.
- 73 Loc. cit.
- 74 Ibid., Frissard to Oursel, 24.III.1838.
- 75 Loc. cit.
- 76 Ibid., LeMaistre to the Commission des Chemins de fer au Havre, 29.III.1838.
- 77 Ibid., LeMaistre to Reilly, 19.III.1838.
- 78 Le Moniteur Universel, 26.IV.1838, pp 1025ff.
- 79 ACCIH 21, LeMaistre to Oursel, 4.IV.1838.
- 80 Railway Times, vol 1, 30 June 1838.
- 81 Revue des Deux Mondes, vol 14, (1838), p 130.
- 82 ACCIH 21, LeMaistre to Oursel, 4.IV.1838.
- 83 Le Moniteur Universel, 17.VI.1837, p 1551.
- 84 Marcel Marion, Histoire financière de la France depuis 1715, (Paris 1914-1931), vol 5, p 163.
- 85 Arch. Nat. F14.8863, Frissard to Directeur-général des Ponts et Chaussées, 12.V.1838.
- 86 Ibid., Société en commandite, 14-15.V.1838.
- 87 ACCIH 21, Mermillod to CC Havre, 17.V.1838.
- 88 ACCIH 21, Mermillod to CC Havre, 18.V.1838.
- 89 Le Moniteur Universel, 27.V.1838, p 1420.
- 90 Arch. Nat. F14.8863, Société Anonyme, Chemin de fer de Paris à la Mer, 6.VI.1838.
- 91 A.-J. Tudesq, Les grands notables en France (1840-1849), (Paris 1964) vol 1, p 431.
- 92 Frissard, Histoire du Port du Havre. Chemin de fer Paris au Havre, (Nevers 1840), p xliii.
- 93 The sale was on the 22nd of May 1838; Lévy-Leboyer, op. cit., p 623n130.
- 94 Frissard, op. cit., p lxi.

95 Léon Faucher, "De la souscription directe dans les entreprises de travaux publics," Revue des Deux Mondes, vol 14 (1838), p. 701.

96 Lévy-Leboyer, op. cit., p 623nl30.

97 Frissard, op. cit., p lxii.

98 Ibid., p lxii.

99 Arch. Nat. F14.8863; Cie Paris à la Mer, 21 Juin 1839. "Le nombre de souscripteurs s'élève à 3967, repartis en categories ainsi qu'il suit —

"de 1 à 10 actions	3222
11 à 50	577
51 -100	69
101 -200	39
201 -300	17
301 -400	12
401 -500	8
501 et au dessus	23"

100 Faucher, op. cit., p 704, gives a detailed break-down of Cie Riant subscribers.

101 Railway Magazine, vol 5, July 1838, p 59.

102 Arch. Nat. F14.8863, "Situation financière de la Cie Paris à la mer, le 14 juin 1839."

103 B. Gille, La banque..., op. cit., pp 337ff.

104 Data for this figure has been taken from the Journal du Havre, reports on the Bourse de Paris, 1838 and 1839, and from the Journal des Chemins de Fer, vol 8 (1851), pp 52-54.

105 The Morning Post, quoted in the Railway Times, vol 1, 10 November 1838, p 656. One banker wrote, "Je ne voudrais toucher à aucun chemin de fer, ni d'ancienne, ni de nouvelle émission." Lévy-Leboyer, op. cit., p 636.

106 The company reported that 2,548 shares were unsubscribed; this was because some were mistakenly thought to have been subscribed, some potential subscribers could not get the exact number of shares they requested and had therefore declined to subscribe at all, and some other potential subscribers were seen by the conseil d'administration to have been poor financial risks, "susceptible de litige". Chemin de fer de Paris à la mer. Rapport du comité d'administration, (Paris 1839).

107 Ibid.

108 Lévy-Leboyer, op. cit., p 661nl34; and Gille, op. cit., p 343, says that Delamarre, Martin, Didier et Cie was the only Parisian bank at this time to obtain such a loan.

109 Chemin de fer de Paris à la mer. Rapport, op. cit., Account of expenditures to 11.VIII.1839.

110 Cahier des charges, in Procès-verbaux des séances de la Chambre des députés, 1838, t 5, pt 3, annexe no. 243, p 1530.

111 Arch. Nat. F14.8863, Cie du Chemin de fer de Paris à la mer to Directeur-général des Ponts et Chaussées.

112 Chemin de fer de Paris à la mer. Rapport, op. cit., Note A, locomotives. The following locomotives were purchased:

1. Sharp, Roberts of Manchester		
10 locomotives @ £1,460		369,380 F
2. Fenton, Murray and Jackson, Leeds		
4 locomotives @ £1,500		
1 tender @ 250		158,125 F
3. Robert Stephenson, London		
1 locomotive @ £1,575		
1 tender @ 220		46,956 F

113 Frissard, op. cit., p lxiv.

114 Railway Magazine, vol 5 (December 1838), p 512.

115 Frissard, op. cit., p lxvi.

116 Railway Times, vol 1, 1 December 1838, p 711.

117 Frissard, op. cit., p lxvi.

118 An article very hostile to the company appeared in L'Egide on the 23rd of November 1838, contained in ACCIH 21.

119 Arch. Nat. F14.8863, Table "Application des prix admis par les ingénieurs de la Cie aux quantités du Projet de M. Defontaine."

120 Ibid., Leboe to the Minister of Public Works, 11.IV.1839, and Frissard, op. cit., p lxviii.

121 Arch. Nat. F14.8863, "Sommaire des demandes de la Cie concessionnaire", 29.VI.1839.

122 Le Moniteur Universel, 11.VI.1839, p 942.

123 The company could certainly have managed with its then current resources and very probable near future receipts to build the line as far as Pontoise; with this knowledge, it would have been wiser to have continued with construction, as the Paris-Orleans in a similar predicament did. The following is a projection of the sources and application of cash for the company up to about August 1840:

Sources of Cash:

'rentes' in portfolio.....	9,098,307 F
cash on hand, as of 11.VIII.1839.....	24,790
current account, Banque de France....	831,563
interest on caution money, 1839-40...	186,000
interest on portfolio, 1839-40.....	261,095
	<u>10,401,755 F</u>
probable further payments on shares.	5,400,000
TOTAL	<u>15,801,755 F</u>

Application of Cash:

Remaining to pay on land already purchased	209,962 F
Remaining to pay on locomotives and tenders	399,049
Remaining to pay on bridge at St.-Denis	12,000
Salaries owing to employees	180,000
Interest on paid-up capital @ 4%	700,000
Administration costs for one year	600,000
Additional rolling stock	1,500,000
Additional land	1,000,000
Purchase and laying of rails	3,750,000
Construction of earth-works, tunnels, viaducts	5,000,000
Construction of stations	2,500,000
TOTAL	15,900,000 F

Amongst the sources of cash listed above, the 'probable further payments on shares' perhaps needs some explanation. Between 14 June 1839 and 11 August 1839, the company received further payments of 896,220 F; if they continued to come in at the same rate, and the prospect was that the financial crisis would diminish over the next few months into 1840, then they would collect about 5,400,000 F. The last six expenditure items above were calculated from company cost estimates. Sources: Chemin de fer de Paris à la Mer. Rapport, op. cit., Accounts to 11 August 1839, and Arch. Nat. F14.8863, "Situation financière de la Cie Paris à la mer, 14 juin 1839".

124 Le Moniteur Universel, 26.VI.1839, p 1099.

125 Le Moniteur Universel, 6.VII.1839, p 1246.

126 Arch. Nat. F14.8863, "Cité de Havre, délibérations du conseil municipal," 25.VI.1839.

127 Ibid., CC Dieppe to Minister of Agriculture, Commerce and Public Works, 25.VI.1839.

128 Chasseloup-Laubat spoke in the Chambre of Deputies on the 6th of July; Le Moniteur Universel, 7.VII.1839, p 1258.

129 Journal du Havre, 18.V.1839.

130 Journal du Havre, 20.VI.1839.

131 Le Moniteur Universel, 7.VII.1839, p 1265.

132 Arch. Nat. F14.8863, Aguado to the Minister of Public Works, 17.VIII.1839.

133 Frissard, op. cit., p lxix.

134 Arch. Nat. F14.8863, M. Communay's, avoué près de la Tribunal Civil de Tarbes (Hautes-Pyrénées) in a letter to the Directeur-général des Ponts et Chaussées, 2.XI.1865, states that he had never received any compensation for the one share he owned.

135 A correspondent of the Globe, reported in the Railway Times, vol 2, 13.VII.1839, pp 535-6, wrote that several of the company's directors had sold large numbers of shares soon after the initial subscription was sold, then when the stock

had fallen considerably in price, they repurchased them, "having resolved upon breaking up the company and being assured that the total loss upon a division would amount to considerably less than the rate of discount at which they had purchased." In a letter of 9.XI.1839 to the Minister of Public Works, Aguado, the President of the company (writing as the duc de las Marismas), Arch. Nat. F14.8863, stated that the conseil d'administration still possessed all its required 20,000 shares, "il n'en a vendu aucune", and accusations of speculation "se trouve ainsi réduit à une pure calomnie".

136 Le Moniteur Universel, 16.VI.1838, pp 1700ff.

137 Ibid., 4.VII.1838, p 1877.

138 See "Observations sur le rapport de la Commission de la Chambre des Députés", in Arch. Nat. F14.8863, and Defontaine, op. cit.

1 ADSM, 5M5, Administration, statistiques: commerce, industrie, enquêtes, 1820-37. "Navigation, Etat indiquant par année le nombre des bateaux, leur chargement par kilogrammes, ...qui ont été chargés à Rouen pour Paris...1^{er} août 1826 (au)... 31 décembre 1834."

2 Ibid., "Etat général du Mouvement de la Navigation du port de Rouen depuis 1827 jusqu'à 1836," and "Etat du Mouvement de la navigation du port de Rouen, divisé en deux parties — Bassin d'amont, années 1836 et 1837, Bassin d'aval, années 1836 et 1837."

3 Administration des Douanes, Tableau général du Commerce de la France..., (Paris, 1825 et seq.)

4 Jean Marczewski, Introduction à l'histoire quantitative, (Geneva 1965), p 149.

5 Ibid., p 145

6 Ibid., p 150.

7 For details see Appendix III.

8 Journal du Havre, 28-29 October 1838 and 1 December 1838.

9 Archives du Havre, vol 2, 5 January 1838, p 210.

10 "Nombre des bateaux à vapeur en France en 1842", Journal des Economistes, vol 10(1845), p 91. It need hardly be pointed out that the last columns of Table 5, taken from this source, are of rather doubtful accuracy.

11 Administration des Douanes, op. cit., and ADSM, 5M5, op. cit., Association normande, session de 1842.

12 Journal du Havre and ADSM, 5M5, op. cit., Association normande, session de 1842.

13 The VESUVE measured 32m.60 by 7m.12, had a draught of 1m.62 and a speed of 16 kph, powered by engines built by Cavé of Paris; the HEVA was 30m.80 by 6m.82, draught 1m.86, speed also 16 kph, engines also built by Cavé. ADSM, Series S, Navigation, statistiques des bateaux à vapeur naviguant sur les fleuves (1834-1850), "Département de la Seine-Inférieure, Etat des bateaux à vapeur," 1835.

14 The NEPTUNE was the largest tug on the Seine at this time, 37m.35 by 7m.45 (121 feet by 25 feet), 1m.88 draught and a speed of 18 kph; its engines were also made by Cavé. Ibid.

15 Arch. Nat. F12.6764, "Balance d'inventaire de la société anonyme des bateaux à vapeur en fer; au 31 décembre 1835."

16 Purchase from Maillet-Duboullay evident from comparison of ownerships recorded in the Journal du Havre and the Moniteur de la Marine; on Pierre LeMarchand, see P. Barry, "Notice sur les constructeurs des navires havrais", Receuil des publications

de la Société havraise des Etudes Diverses, 74e année (1907), p 94.

17 Ibid.

18 Louis Brindeau, Les premiers Bateaux à vapeur au Havre, (LeHavre, 1901) p 32.

19 ADSM, Series S, Navigation, statistiques des bateaux à vapeur naviguant sur les fleuves (1834-1850), 1844.

20 This is a rather rough estimate based on the following calculations: taking the average load of the 411 chalands to be 200 tons, they would carry a total of about 80,000 tons; if about one-third of all the cabotage out of LeHavre went to Rouen (this was the average in 1837-38, the two earliest years known), then the amount of shipping going up to Rouen by allèges was 170,900 tons x 0.33, ie about 50,000 tons. The total traffic between LeHavre was the sum of these two, ie 130,000 tons, of which 80,000 is about 62 per cent.

21 From a count of Bertin's chalands' movements recorded in the Journal du Havre, 1835, and assuming an average load of 165 tons.

22 Numerous examples of this are given in Le Mémorial de Rouen.

23 ADSM, Series M, Commerce, Sociétés Anonymes des Paquebots à Vapeur, arrondissement du Havre, Cie des Paquebots à vapeur sur la Seine; and ADSM, Series S Navigation, statistiques des bateaux à vapeur naviguant sur les fleuves (1834-1850), 1844.

24 Ibid., 1844.

25 Ibid., 1844 and 1835.

26 Ibid., 1844.

27 Fernand Boulé, "Les transports en commun par terre et par eau en Seine-et-Oise, de 1790 à l'établissement des chemins de fer," Revue de l'histoire de Versailles, 33e année (1931), p 125; Guide du voyageur sur les bateaux à vapeur de Paris à Rouen..., (Paris, s.d.)

28 Ch.-J. Minard, Second mémoire sur l'importance du parcours partiels sur les chemins de fer..., (Paris 1843), p 10.

29 ADSM, Series S, Navigation, statistiques des bateaux à vapeur naviguant sur les fleuves (1834-1850), 1844.

30 Ville de Rouen, Conseil municipal, Analyses des procès-verbaux des séances ..., (Rouen 1899), vol 2, 13 March, 25 April, 21 June, 6 August 1833.

31 Arch. de la ville du Havre, F2.8, Sous-préfet to Mayor of LeHavre, 11 March 1834 and 26 May 1834.

32 See Arch. Nat. F12.6818, "Acte de Société," LeHavre, 13-20 November 1843 (The Société des paquebots à vapeur entre LeHavre et Hambourg); ADSM, Series M, Commerce, Sociétés Anonymes

des Paquebots à Vapeur, arrondissement du Havre; Louis Brindeau, op. cit., pp 17-18; an article from the Estafette du Havre, in Le Moniteur Universel, 1 September 1832, p 1654.

33 Ville de Rouen, op. cit., 29 August 1833.

34 Arch. Nat. F12.2615A, extract from Journal du Commerce of 15 November 1832: "D'un autre côté les propriétaires de bateaux à vapeur qui font le remorquage libre au Havre et à Honfleur ont établi entre eux un tarif pour les allèges qui, par son exhorbitance, interdit complètement le remorquage de ces batiments."

35 H. Wallon, Le Magasin de Sauvetage de Quillebeuf et les services qu'il a rendu à la navigation de la Seine, (Rouen 1902), p 231.

36 Arch. Nat. F12.2615A, Delaroche to Minister of Commerce and Public Works, 17 September 1832.

37 Arch. Nat. F12.2615A, Minister of Commerce and Public Works to Delaroche, 20 September 1832.

38 Ville de Rouen, op. cit., 29 August 1833.

39 Ibid., 19 December 1835.

40 Arch. Nat. F12.6765, "Société anonyme, la Cie Rouennaise pour le remorquage des navires montant et descendant la Basse Seine, autorisé par ordonnance royale, 7 Septembre 1837; extrait du registre des délibérations," 2 January 1837.

41 The PILOTIN was a small boat, 24m.4 by 6m.8 and only 61 tons; the second boat was the largest tug to go into service to that date: the ROUENNAIS, 130 hp, 89 tons, 32m.9 by 7m and 2m draught; moreover it was built entirely in France, the engine in LeHavre by Mazeline et Cie, and the hull by Pauwels of Paris. ADSM, Series S, Navigation, statistiques des bateaux à vapeur naviguant sur les fleuves (1834-1850), and Arch. Nat. F12.6765, op. cit., "Etat de situation...au 30 juin 1838."

42 Ibid.

43 Archives de la Ville du Havre, 03.3, comments on the bill to improve the navigation of the Seine, 1845.

44 P.-E. Teisserenc de Bort, Etudes sur les voies de communications perfectionnées et sur les lois économiques de la production du transport, (Paris 1847), p 76. There is little doubt that the mariniers were making very satisfactory profits at the rates charged during the late thirties and early forties. (See Table in Chapter Three). A profit of about five per cent over and above interest and depreciation charges seems to have been possible with rates at a maximum of about 16 F and a minimum of about 12 F. This can be deducted from the following cost figures given by Ch. Bérigny in his "Mémoire sur les moyens de perfectionner la navigation de la Seine entre Paris et Rouen...", 20 January 1834, in Arch. Nat. F14.6813.

Cost figures for river transport in this era, after the innovations of the previous decade had been made and the subject became of less interest to the public, are difficult to obtain. There are several however, for the early 1830s, which cover only bateaux accélérés ordinaires. Those of Bérigny correspond fairly closely with those given by Charles Monier, another Ponts et Chaussées engineer, in De l'Etat actuel de la navigation de la Seine entre Rouen et Paris, et les moyens de le perfectionner, (Paris 1832). Another slightly earlier estimate, which gives the same cost per ton, is contained in Tourasse and Mellet, Essai sur les Batteaux à Vapeur. Considerations sur les Chemins de fer, (Paris 1828-29), p 229. The figures of Bérigny are the most detailed, and the most recent, and take explicitly into account all costs, direct and indirect.

45 Procès-verbaux des séances de la commission chargée d'examiner les questions que peuvent soulever les projets d'établissements de chemin de fer, (Paris 1837), p 45.

46 Arch. Nat. Fl4.1646, report of engineers on project for improvement of Route Royale N0. 14 between LeHavre and Harfleur.

47 The Railway Times, 1 August 1840, meeting of shareholders of the Paris-to-Rouen railway company, Liverpool, 22 July 1840.

48 Almanach du Havre, 1841.

49 See for example Mary, "Notice sur les voitures à vapeur employées en Angleterre sur les routes ordinaires," Annales des Ponts et Chaussées, (1833.1), pp 111-131, and L. Marion "Extrait d'un mémoire sur l'emploi des Voitures à vapeur marchant sur les routes ordinaires," Bulletin de la Société Libre d'Emulation de Rouen, (1839), pp 99-110, who says they were considered as an alternative to branch lines during planning of the Paris-to-Rouen railway. In 1868 and 1869 goods and passenger services by locomotives routiers were established between LeHavre and nearby Montivilliers, Arch. V. du Havre, 12.7.

50 These figures are taken from the following publications, for 1822, Ministère de l'Intérieur, Administration Générale des Ponts et Chaussées et des Mines, Statistique des Routes Royales de France, 1824, (Paris 1824); for 1827, E. Grangez, Discussion et documents sur les canaux, sur les routes et sur les chemins de fer de la France, (Paris 1830), p 129; for 1836, Ministère des Travaux Publics, de l'Agriculture, et du Commerce, Statistique des routes royales de France, (Paris 1837). Definitions of the terms used here are: en état d'entretien - in a good state of repair requiring only normal maintenance; à réparer - requiring repairs, major or minor, to bring it up to good condition; à terminer - sections of road officially scheduled, but not yet built; often means diversions for gradient improvements.

51 Ministère des Travaux Publics, op. cit., (1837).

52 Arch. Nat. AD XIX.N 2, Circular of the 14th of December 1833, N0. 31.

Total costs per voyage between Rouen and Paris in about 1834

(1) upstream:

towing by horses	1,280 F
crew wages and food	500
depreciation and interest on capital at 5% P.A.	500
droits de navigation	336
costs at bridges and pertuis	216
loading and unloading	595
commission at 2½%	88
general administrative costs	140
	<u>3,655 F</u>

(2) downstream:

towing by horses	160 F
crew wages and food	250
depreciation	150
droits de navigation	116
costs at bridges and pertuis	104
loading and unloading	255
commission at 2½%	20
general administration	60
	<u>1,116 F</u>

Total costs per round-trip voyage therefore were 4,761 F.

Revenue per voyage varied according to the season, as the load varied. Using the information supplied by Collignon, in Du concours des canaux et des chemins de fer et d l'achèvement de canal de la Marne au Rhin, (Paris 1845), p 70, it appears that the annual maximum freight rate would be charged during five months of the year when water levels were lower than one metre at Vernon, about 16 F per ton in 1834 and 1835. The maximum load was also reduced probably to about 200 tons. For the rest of the year the freight rate would be close to the minimum, about 12F.50, and the possible load would be 350 tons. The revenue for upstream voyages averaged therefore at 3,880 F. For downstream voyages the tonnage capacities were the same; revenue from general cargo was between 6 and 7 F per ton, and from plaster 2 F per ton. Average revenue for downstream voyages was 1,133 F. This leaves a net revenue of 252 F per voyage; assuming about 2 voyages per year, this is a return on capital over and above normal interest, ie. a profit, of about five per cent per year.

To test the assumptions used above the following calculation was done. The principal assumption was that full (seasonal) capacity loads were carried. In 1835, of the 820 voyages reported, 411 were by Bertin's chalands, leaving 409 by bateaux accélérés and others. If each of the latter carried an average of 290 tons, then the total amount carried by them would be about 120,000 tons. If this amount is added to the 50,000 tons estimated to have been carried by chalands, the resulting total annual tonnage is 170,000 tons; the actual recorded total upstream freight in 1835 was 179,668 tons.

53 Ministère des Travaux publics, Direction général des ponts et Chaussées et des chemins de fer, Documents statistiques sur les routes et ponts, (Paris 1873), 'Notice historique'.

54 Félix Ponteil, Les Institutions de la France de 1814 à 1870, (Paris 1965), p 197.

55 Berthault-Ducieux, Historique, situation et raison d'être du service d'expériences sur l'entretien des routes, (Paris 1845).

56 For an excellent treatment of MacAdam's techniques, see R.J. Forbes' article, "Roads to c. 1900", in A History of Technology, eds. Singer et al., (London 1958), vol 4, pp 520-547.

57 Navier, "Considerations sur les travaux d'entretien des routes en Angleterre," Annales des Ponts et Chaussées (1831.2), pp 132-156; this report had been submitted by Navier in 1822.

58 Annales des Ponts et Chaussées, lois et ordonnances, 1839, p 114.

59 In his Cours d'économie politique, 2e édn. vol 2, cited by Cavaillès in La route française, (Paris 1946), p 172.

60 Cavaillès, op. cit., p 173.

61 Garnier, "Experiences et observations sur les frais d'entretien des routes en empièrrement, et principalement sur l'usure des Chaussées," Annales des Ponts et Chaussées (1845.2), p 178.

62 Circular of 21 January 1856, "Routes impériales - entretien", Annales des Ponts et Chaussées, lois et ordonnances, 1856.

63 Ordonnance of 15 February 1837, Annales des Ponts et Chaussées, lois et ordonnances, 1837.

64 Calculated from data obtained in the Journal du Havre, 1827 and 1835.

65 Bérigny, op. cit.

66 J. Vidalenc, Le département de l'Eure sous la Monarchie Constitutionnelle, (Paris 1952), p 55, "Rapport du Préfet au Conseil-général de l'Eure," 1845.

67 ADSM, Series S, Navigation, statistiques des bateaux à vapeur naviguant sur les fleuves (1834-1850), 1844.

68 Michel Chevalier, "Statistique des travaux publics sous la monarchie de 1830", Journal des Economistes, vol 21, (1848), p 292.

69 Ernest Grangez, Précis historique et statistique des voies navigables de la France et d'une partie de la Belgique, (Paris 1855), p 746.

70 Procès-verbaux des séances de la Chambre des députés, Impressions, (1835), Annexe N^o. 188, "Exposé des Motifs et projet de loi sur les rivières...", séance du 2 Avril 1835", p 137-138.

71 Michel Chevalier, "Des chemins de fer comparés aux lignes navigables," Revue des Deux Mondes, vol 13(1838), p 811.

72 Arch. Nat. F14.6813, "Mémoire sur les moyens de perfectionner la navigation de la Seine entre Paris et Rouen...", 20 January 1834.

73 R. Musset, "La canalisation des rivières en France", Annales de Géographie, vol 47 (1938), pp 500-504, contains an excellent concise description of the evolution of canalization techniques in France.

74 Ibid., p 501.

75 An experiment of this kind was carried out on the Loire at Chouzé (Indre-et-Loire) in 1825; the cost was considerable, and the result was a channel even more obstructed by alluvions than before. See Beaudemoulin, "Considérations sur le système de rétrécissement par des digues submersibles proposé pour l'amélioration des rivières à fond mobile et essayé sur la Loire, en 1755 et en 1825", Annales des Ponts et Chaussées (1833.1), pp 330-375.

76 The word 'pertuis' has two meanings. It denotes both the rapids formed by shallow water at various places on the lower Seine, and also the openings in dams, through which water is allowed to flow.

77 Arch. Nat. F14.6813, "Examen du projet présenté par M. l'inspecteur-général Bérigny", by inspecteurs-généraux Cavenne, Vauvilliers, Prony, Lamandé and Lamblardie, 1 March 1835.

78 In 1830 Coic had proposed a series of by-passing canals, or "canaux de dérivation", to be built at seven places; they would be created in the river-bed by joining up islands and building locks in the channels so created. At three other places, where there were bridges; independant canals would be built; see Coic and Duleau, Reconnaisances de la Seine de Rouen à St.-Dénis, en 1829 et 1830; et travaux proposés pour rendre cette partie de la Seine facilement navigable, (Paris 1830), pp 50-51.

79 Charles Monier, De l'Etat actuel de la navigation de la Seine entre Rouen et Paris, et les moyens de la perfectionner, (Paris, November 1832).

80 Arch. Nat. F14*.10912.90, Procès-verbaux des séances du Conseil-général des Ponts et Chaussées, sessions of 9 and 24 April, 9, 16, 23, 30 June, 7, 10, 16 and 21 July, 1836.

81 Arch. Nat. F14.2302.1, dossier personnel, Charles-Antoine-François Poirée, 11 November 1785-31 March 1875.

82 Another of these dams was built by Poirée and Chanoine at Epineau on the Loire, near Decize, in 1836. It and the system in general are described by Chanoine in his "Mémoire sur le barrage d'Epineau", Annales des Ponts et Chaussées (1839.1), pp 238-280; there are diagrams in the volume numbered 1839.2, plates 157, 158.

83 Arch. Nat. F14*.10912.90, op. cit., sessions of 21 and 25 August and 1 September, 1836.

84 Chambre de commerce de Rouen, Rapports sur les questions relatives à l'amélioration de la Seine et sur la proposition de divers barrages, (Rouen 1837).

85 Procès-verbaux des séances de la Chambre de commerce du Havre, vol 5 and 6, 8 April 1836 and 3 June 1836; the CC Havre received a letter from the Prefect on the 6th of April 1836 outlining proposals by Bérigny and by Poirée; a committee of three was selected to report on the matter.

86 Chambre de commerce de Rouen, op. cit.

87 Bibliothèque de la Chambre de commerce de Rouen, Documents, I-7-D2.6, "Projet d'amélioration de la Navigation de la Seine, entre Paris et Rouen", signed Poirée, 18 February 1836.

88 Arch. Nat. F14.6815, Projet de Poirée, Report by Cavenne, 9 December 1836.

89 Arch. Nat. F14*.10912.92, Procès-verbaux des séances du Conseil-général des Ponts et Chaussées, sessions of 9, 13, 16 and 20 December 1836.

90 Le Moniteur Universel, 13-14 June 1837.

91 Situation des Travaux, op. cit., 1837, 1838.

92 Arch. Nat. F14.2302.1, op. cit.

93 Situation des Travaux, op. cit., 1837.

94 Ibid., 1838, 1839, 1840.

95 See J. Aubert, Barrages et canalisations, (Paris 1949), p 147.

96 Bibliothèque de la Chambre de commerce de Rouen, op. cit.

1 Edward Charles Blount, Memoires of Sir Edward Blount, Ed. S.J. Reid, (London 1862), p. 52; Blount states that he approached Dufaure in 1838; he must mean 1839, as Dufaure did not become Minister of Public Works until the 12th of May 1839.

2 R. Guyot, La première entente cordiale, (Paris 1926), p 140n3.

3 Ibid., p 142.

4 In 1838 and 1839 there were only two companies formed in each year, and in the following years of 1840, 1841, 1842 and 1843 respectively, there were only zero, one, five and three companies formed; this contrasted with 29 in 1836 and 15 in 1837. H.G. Lewin, Early British Railways, (London 1925), p 186.

5 S.A. Broadbridge, "The Early Capital Market: the Lancashire and Yorkshire Railway," Economic History Review, vol 8 (1955), p 212.

6 C.H. Ellis, British Railway History, (London 1954), vol 1, p 83.

7 The Railway Times, vol 2, 10 August 1839.

8 Ibid., vol 3, 7 March 1840.

9 Loc. cit.

10 Arch. Nat. F14.8863, Chambre de commerce de Rouen to Minister of Public Works, 28.IX.1839; Chambre de commerce d'Elbeuf to Minister of Public Works, 24.XI.1839; petition from the citizens of LeHavre to Minister of Public Works, 20.XII.1839; ACCIH 21, Chambre de commerce de Dieppe to the Chambre de commerce du Havre, 16.VIII.1839.

11 Ibid., Committee of Chambre de commerce du Havre and Conseil municipal du Havre to Minister of Public Works, 10.II.1840.

12 Ville de Rouen, Conseil municipal, Analyses des procès-verbaux, (Rouen 1899), vol 4, 12.II.1840.

13 This is apparent from correspondence in ACCIH 21, during the early months of 1840.

14 ACCIH 21, Clerc to CC Havre, 12.IV.1840.

15 ACCIH 21, M. Chevalier to J. Clerc, 28.IV.1840.

16 The Minister's words were reported by J. Clerc in a letter to CC Havre, on the 22nd of May 1840, in ACCIH. 21.

17 The English capitalists involved, wrote Guizot, "are among the best money securities this country can offer." Furthermore, "one of them, Mr. Easthope, is proprietor of the Morning Chronicle, and a member of the House of Commons. Without immediate reference

to the Rouen railway, it is well to be on amicable terms with him;" François Guizot, An Embassy to the Court of St. James in 1840, (London 1862), p 112.

18 Loc. cit.

19 Ville de Rouen, op. cit., vol 4, 23.III.1840.

20 Report of the Committee of the Chambre des Pairs on the Paris-to-Rouen railway bill; Le Moniteur Universel, 8.VII.1840, p 1633.

21 Arch. Nat. 42 AP 172, (Fonds Guizot), Jaubert to Guizot, 18.V.1840.

22 ACCIH 21, Mermillod to Reilly, 15.V.1840.

23 Le Moniteur Universel, 24.V.1840, p 1166f.

24 Bulletin des Lois, 9e série, vol 21 (1840), law of 15 July 1840.

25 Arch. Nat. 42 AP 172, letter of 18.V.1840.

26 A good examination of the Commission's work is contained in Picard, Les chemins de fer français, (Paris 1884), vol 1, pp 178f; its membership was drawn from the Administration, the 'haute banque', and from business: the comte d'Argout, Baude, Cavenne, François, baron de Fréville, Jaubert, Kermaingant, Legentil, Rivet and Vivien; Valentin Smith was its secretary. The procès-verbaux of its meetings are contained in Arch. Nat. Series 12AQ.

27 The Railway Times, 8 August 1840, Shareholders' meeting of the Paris-to-Rouen railway, 30 July 1840.

28 This information was given by Jaubert during the debate in the Chambre des députés, and can be found in Le Moniteur Universel, 17.VI.1840, p 1466.

29 Report of the committee of the Chambre des députés on the Paris-to-Rouen railway bill, rapporteur Garnier-Pagès, session of 9.VI.1840, Le Moniteur Universel, 11.VI.1840, p 1366.

30 Alphonse Charles Courtois, Bourse des effets publiques. Paris-Lyon-Marseille. Tableaux des cours des principaux valeurs du 17 janvier 1797...à nos jours..., (Paris 1862), p 259.

31 The Railway Times, vol 3, 8 August 1840.

32 Le Moniteur Universel, 17.VI.1840, p 1466.

33 Ville de Rouen, op. cit., 1.VI.1840.

34 The Railway Times, vol 3, 4.VII.1840.

35 Maurice Lévy-Leboyer, Les Banques européennes et l'industrialisation internationale dans la première moitié du XIXe siècle, (Paris 1964), p 664n146.

36 Detailed revenue calculations were presented to the meeting of shareholders of the Paris-to-Rouen railway at Liverpool on 22 July 1840, and reported in The Railway Times, vol 3, 1.VIII.1840:

Table of Estimated Revenues for the Paris-to-Rouen Railway

Passengers:

Passengers now travelling by 'diligence'	132,987
One-quarter of passengers now travelling by steamer (though it was believed that all of these would use the railway	29,707
Passengers now travelling in private carriages	22,164
'Méssageries', now carried by 'diligence',...	120,702

Goods:

188,500 tons of goods which now go by road, which now do the journey in 2 to 10 days, to be charged 22s (27F.50)	207,350
97,500 tons of goods which now go by water, to be charged 20s per ton (25 F).	97,500
272,000 tons of goods from intermediate points on the line, to be charged an average of 5s per ton (6F.25)	68,000

Total gross revenue from present estimated traffic charges at railway rates	676,410
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37 Arch. Nat. 42 AP 172, Jaubert to Guizot, 18.V.1840.

38 Report of the committee of the Chambre des députés on the Paris-to-Rouen railway bill, Le Moniteur Universel, 11.VI.1840, p 1366.

39 Report of the committee of the Chambre de Pairs on the Paris-to-Rouen railway bill, Le Moniteur Universel, 8.VII.1840, p 1633.

40 Arch. Nat. 42 AP 172, Jaubert to Guizot, 5.XI.1840.

41 ACCIH 21, Clerc to CC Havre, 13.VII.1840.

42 Ibid., Clerc to CC Havre, 3.VIII.1840.

43 Ibid., CC Havre to Minister of Public Works, 10.XII.1840.

44 Ibid., Clerc to CC Havre, 4.III.1841.

45 Reported in the Journal du Havre, and copied in the Railway Times, vol 5, 12.III.1842.

46 ACCIH 21, procès-verbal du Conseil municipal du Havre, 21.IV. 1842; Charles Laffitte is said to have insisted upon this as a condition for the company's acceptance of the lower tariff; from the Journal du Havre, reported in the Railway Times, vol 5, 30.IV.1842.

47 Stated at the Liverpool meeting of British shareholders of the Paris-to-Rouen railway, 29.IX.1842, The Railway Times, 8.X.1842.

48 Teste, the Minister of Transport, presented his bill on the 29th of April 1842; Le Moniteur Universel, 30.IV.1842, p 966.

49 Report of the committee of the Chambre des députés, rapporteur Vitet, session of 25.V.1842; Le Moniteur Universel, 28.V.1842, p 1295f.

50 Bulletin des lois, série 9, 1er partie, vol 24 (1842), p 657; law of 11.VI.1842.

51 The company's charter containing a list of subscribers, dated 31.XII.1842, is contained in Bulletin des lois, série 9, partie supplémentaire, vol 23 (1843), p 161, ordinance of 29.I.1843.

52 Journal des Chemins de Fer, vol 8, (1851), p 53.

53 Ibid., 15.IV.1843, p 493.

54 Amongst these there were several very large subscribers, the ship-owner Albrecht 300 shares, the bankers Dubois and Delessert 400 and 380 respectively, and merchants Du Rouveray et Cie 380 shares.

55 Journal des Chemins de Fer, 27.VII.1844, p 414.

56 Ibid., 25.I.1845, p 31.

57 Ibid., 8.III.1845, p 128.

58 Participants in this company included Charles Séguin, an administrator of the St.-Etienne-Roanne railway and the Montereau-Troyes railway, several British from the Brighton area, including Henry Simonds, an administrator of the Chichester and Brighton Railway, Dulong, directeur de materiel for the Entreprise des messageries général, baron Félix Heron de Villefosse, and Thomas Crétu; in Journal des Chemins de Fer, 8.II, 17.V.1845.

59 Ibid., 9.VIII.1845.

60 Bulletin des lois, série 9, vol 31 (1845), p 368, law of 19.VIII.1845.

61 Bulletin des lois, série 9, vol 31 (1845), p 602, ordinance of 18.IX.1845; the concession was signed on the 13th of September. A company charter was registered on the 8th of October 1845, Bulletin des lois, série 9, partie supplémentaire, vol 28, p 457.

62 Arch. Nat. F12.6065, list of subscribers to Rouen-to-Dieppe railway shares. The exact breakdown of shareholders according to this list is: shares subscribed in Paris and banlieue 24,557; in Great Britain 5,455; in Rouen and its dependent towns 2,496; in Dieppe 1,964; in Fecamp 254; in LeHavre 78; elsewhere in France outside of Paris 1,149. Amongst individual subscribers were the three Séguin brothers (Camillo, Paul, and Charles) 1,050 shares; several banks, Macuard et Cie 266, Rougemont de Lowenburg 349, Allégri et Cie 25, Lecoite des Arts et Cie 233, Fould, Fould et Oppenheim 266; Madam Jaubert 250, Thomas Brassey 133, Buddicom 66, Allcard, Buddicom and Co. 13, Henry Barbet (mayor of Rouen) 263.

63 Meeting of shareholders at Liverpool, 24.XI.1841, in The Railway Times, vol 4, 27.XI.1841.

64 A.-J. Tudesq, in Les grands notables en France (1840-1849), (Paris 1964), 424f, analyzes the social composition of several sociétés anonymes, amongst them several railway companies. Their most salient characteristics were a preponderance of bankers and of aristocratic notables of all kinds. In the second respect, the Paris-to-Rouen certainly conformed; however, it was exceptional in two other ways, first in the large number of British directors, and second in the considerable previous railway experience of the four British directors.

65 Nouvelle biographie générale, (Paris 1866), vol 45, "Adolphe Thibaudeau", b. 1795 - d. 1856.

66 Meeting of shareholders of the Paris-to-Rouen railway, Paris, July 1840; The Railway Times, vol 4, 11 December 1841.

67 Charter of the Rouen-to-LeHavre railway company, Bulletin des lois, série 9, partie supplémentaire, vol 23, p 161, ordinance of 29.I.1843.

68 Charter of the Rouen-to-Dieppe/Fécamp railway company, Bulletin des lois, série 9, partie supplémentaire, vol 28, p 457, ordinance of 14.X.1845.

69 Bertrand Gille, Recherches sur la formation de la grande entreprise capitaliste (1815-1848), (Paris 1959), p 100.

70 A.L. Dunham, The Industrial Revolution in France, 1815-1848, (New York 1955), pp 446-7.

71 This condition was written into the company's charter in 1840.

72 Robert Keith Middlemas, The Master-Builders, (London 1963), p 35.

73 See Joseph Devey, The Life of Joseph Locke, Civil Engineer, (London 1862), passim.

74 Michael Robbins, "From R.B. Dockray's Diary - II," Journal of Transport History, vol 7, NO 2, (November 1965), entry of 21.VIII. 1860.

75 Alphonse Joanne, Atlas historique et statistique des chemins de fer français, (Paris 1859), p 18.

76 The Railway Times, vol 2, 10.VIII.1839, shareholders' meeting of the London and Southwestern Railway.

77 Ibid., vol 3, 20.II.1840, report from the Hampshire Independent.

78 Meeting of shareholders of the Paris-to-Rouen railway, Liverpool, 22 July 1840; The Railway Times, 1.VIII.1840.

79 Meeting of shareholders of the Paris-to-Rouen railway, Liverpool, 24 November 1841, The Railway Times, 27.XI.1841.

80 Meeting of shareholders of the Paris-to-Rouen railway, Paris, 31 October 1844, Journal des Chemins de Fer, 2.XI.1844, p 581.

81 Journal des Chemins de Fer, 28.X.1843, p 729.

82 Report of the committee of the Chambre des députés, session of 25.V.1842, Le Moniteur Universel, 28.V.1842, p 1295f.

83 Meeting of shareholders of the Rouen-to-LeHavre railway, Paris, 10 December 1845, Journal des Chemins de Fer, 13.XII.1845, p 934.

84 Le Moniteur Universel, 12.VI.1845, p 1673f.

85 Harold Pollins, "A Note on Railway Construction Costs 1825 - 1850," Economica, vol 19 (1952) N.S., pp 395-407.

86 The law on expropriation for the public utility, 3.V.1841, Bulletin des lois, série 9, vol 22, (1841), p 650. This law replaced those of 8 March 1810 and 7 July 1833.

87 This was a complex process which was the source of delay only on a very few occasions. It took the following form: Taking into account the outline of a route prescribed in the cahier des charges the company drew up an avant-projet, which was approved by the Minister. Detailed plans and états parcellaires were then prepared and sent by the prefect of each département to the mayors of each affected commune. After receiving their responses, in the form of procès-verbaux, the prefects named committees of inquiry composed of members of the Conseils généraux, representatives of the communes affected and of the company. The procès-verbaux of these groups were then sent to the government-appointed ingénieurs de contrôle, upon whose advice the Conseil-général des ponts et chaussées and Minister approved the final plan agreed to in this process. The prefects then, by an arrêté de cessibilité, declared the designated lands to be transferred to the public domain. The value of expropriated land was then fixed by local juries. This account is taken from Joseph Locke, "Address of the President," Proceedings of the Institution of Civil Engineers, (1858), pp 6-7.

88 The Railway Times, vol 5, 17.IX.1842.

89 Some examples are given in the Journal des Chemins de Fer, 15.III.1842, p 27.

90 The cost of land per kilometre of railway line is given for a number of lines in Arch. Nat. AD XIX. N.87, Ministère de l'Agriculture, du Commerce et des Travaux publics, Documents Statistiques sur les Chemins de fer, (Paris 1856), p lxxvi.

91 Journal des Chemins de Fer, 13.XI.1845, p 934.

92 Meeting of shareholders of the Rouen-to-LeHavre railway, 10 December 1845, Journal des Chemins de Fer, 13.XII.1845, p 934-36.

93 Lévy-Leboyer, op. cit., pp 368-369.

94 The Railway Times, vol 4, II.XII.1841, and the testimony of William Reed to the House of Commons Select Committee on Railway Act Enactments, in Great Britain, Second Report from the Select Committee on Railway Act Enactments, Parl. Papers, 1846, XIV, 687, questions no. 83-94. According to Reed the cost of rails was about two-thirds higher than it had been on the London and Southwestern. The contract for supply of rails is said to have been given to five firms, among which were Fourchambault, Anzin and Le Creusot; Vauquésal-Papin, "Origines de la construction de la ligne de Paris à Rouen, 1825-43," La vie du Rail, NO. 1089 (1967), p 13.

95 Meeting of shareholders of the Paris-to-Rouen railway, 30 August 1842, The Railway Times, vol 5, 17.IX.1842.

96 Journal des Chemins de Fer, 17.XII.1842, p 277.

97 Ibid., 24.VI.1843, p 573.

98 In May 1844 8,000 tons of rails were ordered from four factories, Alais, Moyeuve, Hayange, and Le Creusot at a price of 340 F per ton; ibid., 18.V.1844, p 250. A further 6,000 tons were ordered in June 1844 for 347F.50 per ton; ibid., 25.V.1844, p. 271.

99 Orders were placed with Decazeville, Alais, Maubeuge, and Fourchambault; all met their delivery dates by the end of April 1847; see meeting of shareholders of the Rouen-to-Dieppe railway, 30 April 1847, ibid., 1.V.1847, p 342f.

100 Lévy-Leboyer, op. cit., pp 348 and 357.

101 Locke, op. cit., p 19.

102 During the period 1840 to 1843 no new orders were received by French locomotive manufacturers, while 57 were imported and 50 were built by Buddicom at his factory in Rouen. Flachet (ed.), Compte rendu des travaux du comité de l'Union des constructeurs, (Paris 1841), p 110.

103 Flachet, op. cit., "Pétition adressée à M. le Ministre des finances," 7.VII.1841, p 79.

104 Dictionary of National Biography, "Joseph Locke", vol 34.

- 105 Flintshire County Record Office, 135/5, Locke to Buddicom, 28.XII.1840.
- 106 Ibid., Locke to Buddicom, 9.III.1841.
- 107 Ibid., Locke to Buddicom, 19.IV.1841.
- 108 Blount, op. cit., p 75.
- 109 P. Duchemin, Sotteville-les-Rouen et le faubourg St.-Sever, (Rouen 1893), p 495.
- 110 Testimony of Brassey to the parliamentary select committee on Railway Act Enactments, op. cit., question no. 824.
- 111 Meeting of shareholders of the Paris-to-Rouen railway, Paris, 30 August 1842, The Railway Times, vol 5, 17.IX.1842.
- 112 Journal des Chemins de Fer, 12.XI.1843, p 258.
- 113 Ibid., 25.II.1843, p 410.
- 114 Meeting of shareholders of the Paris-to-Rouen railway, Paris, 31 July 1845, Journal des Chemins de Fer, 2.VIII.1845, p 582.
- 115 Meeting of shareholders of the Rouen-to-LeHavre railway, Paris, 29 October, 1846, Journal des Chemins de Fer, 31.X.1846, p 868.
- 116 Ibid., 11.IV.1846, p 305.
- 117 These 665 locomotives had been built by Robert Stephenson 224, Sharp Roberts 196, Hawthorn 70, Nasmyth 60, Forster 80, and Fairbairn 35; ibid., 4.IV.1846, p 279.
- 118 Ibid., 24.VIII.1844, p 458.
- 119 Testimony of William Reed to the parliamentary select committee on Railway Act Enactments, op. cit., question no. 504.
- 120 The Railway Times, vol 4, 27.II.1841.
- 121 Journal des Chemins de Fer, 21.II.1846, p 153.
- 122 Locke, op. cit., p 21.
- 123 Much has been written about Brassey, and nothing of a general nature can be added here. The reader can refer to Middlemas, op. cit., Helps, Life and Labours of Mr. Brassey, 1805-1870, (Boston, Mass. 1874), and Thomas Brassey (his son), Work and Wages practically illustrated, (New York 1872).
- 124 Helps, op. cit., p 80.
- 125 Flachet, op. cit., pp 135-138.
- 126 Testimony of William Reed, op. cit., questions no. 327 & 328.

127 Maurice Wallon writes in Les Saint-Simonians et les Chemins de Fer, (Paris 1908), p 74, that Le Courrier français reported in 1837 that troops were being used to construct a bridge at Aisnières on the Paris-to-St.-Germain railway.

128 Locke remarked that little difference in unit costs would result from using British workers paid at twice the rate received by French workers; "although labour in France (is) one-half the price it (is) in England, it (is) well known that the workmen of France (do) only one-half the work that men in England (perform)." From the meeting of shareholders of the London and Southwestern Railway, 29 February 1840, The Railway Times, vol 3, 7.III.1840.

129 Tables of industrial wages in Rouen are given in Archives départementales de la Seine-Maritime, Series M, Statistiques industrielles (1840-1852). In March 1841, for example, charpentiers were receiving 2F.50 to 3 F, constructeur-mécaniciens 3 F to 4F, filateurs 2 F to 2F.25, maçons 2F.50 to 2F.75, teinturiers en bleu 2 F to 2F.50.

130 Helps, op. cit., p 63.

131 Ibid., p 67.

132 Testimony of William Reed, op. cit., question no. 505.

133 Brassey's testimony to the select committee on Railway Act Enactments, op. cit., question no. 863.

134 The Railway Times, vol 5, 10.XII.1842.

135 Testimony of William Reed, op. cit., question no. 409.

136 Helps, op. cit., p 91.

137 The "excavateur américain" was first used in France on the Chemin de fer du Nord on the 30th of October 1843, by the British contractor Sherwood; Journal des Chemins de Fer, 4.XI.1843, p 740.

138 Ibid., 9.IX.1843, p 675.

139 These cost figures are derived from data contained in J. Weale, Ensamples of Railway Making, (London 1843), pp xxi-xxvi, which contains a picture of the machine on page xxiii, and from evidence given by one of Brassey's agents, Mr. Ballard, in Helps, op. cit., p 77.

140 Journal des Chemins de Fer, 23.III.1844, p 138.

141 Testimony of William Reed, op. cit., questions no. 386, 398-400.

142 Ibid., question 357.

143 It was built for the Gravelle-LeHayre section and supervised by Dr. Douglass; Journal des Chemins de Fer, 29.III.1845, p 204.

144 A school was opened at 55, rue St.-Hilaire in Rouen in January 1844; the other two were opened during the rest of 1844. All were operated on the principles of the Société nationale pour l'éducation des pauvres, and were financed by donations from the railway company's directors, from Brassey (500 F), the King (1,000 F), the British Ambassador, the British Queen-Mother and many others. Journal des Chemins de Fer, 13.IV.1844, p 190, and 18.I.1845, p 33.

145 Unemployment in England was very high at this time, and a large number of unemployed came over to France to work on railway construction. They were undeterred by advertisements such as that which appeared in The Railway Times on 31.VII.1841 warning that "it is the intention of the Directors of the railway to employ the native Workmen of the country. They do not at present hold out any prospect of work to British labourers beyond the number already on the line." It may be doubted how many of the people to whom such an advertisement was directed would or could read it.

146 There is an interesting series of correspondence between Gilbert Gordon and the Foreign Office in the Public Record Office, FO 27/608-676. It is evident that Gordon gave money to a large number of unemployed British workers from his own pocket. At the beginning of 1843 he sent in a list of 204 British subjects who had received official assistance during 1842; among them there are 117 workers from the Paris-to-Rouen railway and their families; FO 27/655/14 enclosure, 11.II.1843.

147 Helps, op. cit., p 93.

148 Journal des Chemins de Fer, 30.XII.1843, p 832.

149 Ibid., 27.I.1844, p 38.

150 Ibid., 17.VIII.1844, p 447.

151 Ibid., 30.XI.1844, p 632.

152 Ibid., 27.III.1847, p 222.

153 Ibid., 28.II.1846, p 189.

154 Ibid., 23, 28.II.1846, pp 162 & 253.

155 Ibid., 24.I.1846, p 63.

156 Ibid., 9.V.1846, p 420.

157 Meeting of shareholders of the Paris-to-Rouen railway, Paris, 30 August 1842, The Railway Times, 17.IX.1842.

158 Journal des Chemins de Fer, 1851, p 53.

159 Approved by a shareholders' meeting in Paris, 30 July 1840; The Railway Times, vol 3, 8.VIII.1840.

160 Meeting of shareholders of the Paris-to-Rouen railway, Paris, 31 October 1844, Journal des Chemins de Fer, 2.XI.1844, p 581.

161 The loan consisted of 6,000 bonds with a par value of 1,000 F, put on sale to non-shareholders at 1,250 F; each paid annual interest of 40 F, ie. 4% of the par value. Similar bond issues had recently been made by the Paris-to-Orléans and Paris-St.-Germain companies. From the Report to shareholders, 31.VII.1845, Arch. Nat., 76AQ4.

162 B. Gille, La banque..., op. cit., p 349.

163 3,833 bonds at 1,000 F each were sold to existing shareholders; 694 were bought by the company's amortization fund. Report to shareholders, 24.I.1846, Journal des Chemins de Fer, 24.I.1846, p 63.

164 Gille, op. cit., p 349.

165 Ibid., p 353.

166 Report to shareholders of the Rouen-to-LeHavre railway company, special meeting of 10.XII.1845, Journal des Chemins de Fer, 13.XII.1845, p 934.

167 Report to shareholders of the Rouen-to-LeHavre railway company, meeting of 29.X.1846, Ibid., 31.X.1846, p 868.

168 Ibid., 15.VIII.1846, p 699.

169 Gille, op. cit., pp 357-361.

170 Journal des Chemins de Fer, 7.XI.1846, p 882.

171 Gille, op. cit., p 356.

172 Report to shareholders of the Rouen-to-LeHavre railway company, meeting of 12.I.1847, Journal des Chemins de Fer, 16.I.1847, p 44.

173 The best rate of interest obtainable from a relatively riskless investment of funds during 1846 — and it should be remembered that risks during this period of crisis were not inconsiderable — was about 4.2%, from 5% rentes. The 'opportunity costs' of internal funds was therefore only 4.2%; the cost of outside borrowing was 5% or more. With respect to risk it might be recalled how the Paris-to-Rouen company barely escaped a minor disaster in 1840, from the failure of its bankers Messrs. Wright and Co. of London. The company's funds on deposit with this firm had only shortly before been converted into Exchequer Bills; The Railway Times, vol 3, 5.XII.1840.

174 Gille, op. cit., p 364.

175 Ibid., p 366.

176 Journal des Chemins de Fer, 13.XI.1847, p 844-5.

177 Ibid., 11.XII.1847, p 909-10.

178 Ibid., 1.I.1848, p 3.

179 Ibid., 11.XII.1847, pp 912-13.

180 Report to shareholders of the Rouen-to-LeHavre railway company of 30 April 1848, Journal de Chemins de Fer, 6.V.1848, p 244.

181 Journal des Chemins de Fer, 13.V.1848, p 256.

182 Ibid., 13.V.1848, pp 242f.

- 1 Quoted from Le Temps of 25 August 1837 in Wallon, Les Saint-Simoniens et les Chemins de fer, (Paris 1908), p 75.
- 2 Vauquésal-Papin, "Origines de la construction de la ligne de Paris à Rouen, 1825-1843", La vie du Rail, NO. 1090 (2 April 1967), pp 14-15.
- 3 The classes of accommodation available on the railway are described as follows in the company's cahier des charges. First class in "voitures couvertes et fermées à glaces, suspendues sur ressorts"; second class in "voitures couvertes et suspendues sur ressorts"; third class in "voitures découvertes mais suspendues sur ressort". See cahier des charges, Article 35 (tarif), in Loi qui autorise l'établissement d'un Chemin de fer de Paris à Rouen, Bulletin des Lois, série 9, vol. 21 (1840), p 279.
- 4 Le Moniteur industriel, 16 May 1837.
- 5 Guide du voyageur sur les bateaux à vapeur de Paris à Rouen, (Paris, n.d.(1840))
- 6 Guide du voyageur par le chemin de fer de Paris à Rouen, (Paris 1843).
- 7 Ch.-J. Minard, Second mémoire sur l'importance du parcours partiels sur les chemins de fer, (Paris 1843), p 10. In France as a whole the volume of passenger travel by road seems to have increased substantially during the 1830s; the revenue from the 'droit sur les voitures publiques' rose by 64 per cent from 1830 to 1840. See J. Dupuit, "Considérations sur les frais d'entretien des routes", in Annales des Ponts et Chaussées, (1842.1), p 73.
- 8 This agreement took effect from the 10th of August 1843, Journal des Chemins de Fer, 2 December 1843, p 789.
- 9 "L'enquête sur l'application des tarifs des chemins de fer-faite en 1850 par le Conseil d'Etat", in Annuaire officiel des chemins de fer, ed. Petit de Coupray, (Paris 1855), p 376.
- 10 Report to Shareholders of the Paris-to-Rouen company, 22 May 1844.
- 11 One recalls for example the 'Hirondelle'-ridden so many times by Madame Bovary between Rouen and Yonville-L'Abbaye, the little town on the plateau not far from Neufchâtel-en-Bray where she lived.
- 12 Minard, op. cit., p 10. As in the case of road passengers these figures are for 1842. Minard states that the passenger steamers between Rouen and Pecq (the terminus of the Paris-to-St.-Germain railway) operated during only six months of the year.
- 13 Journal des Chemins de Fer, 13 May 1843, p 526.
- 14 Ibid., 8 July and 5 August 1843, pp 592 & 637.
- 15 Report to shareholders of the Paris-to-Rouen company, 31 July 1845.
- 16 Loc. cit.
- 17 Journal des Chemins de Fer, 19 October 1844, p 554, Report

to a meeting of British shareholders held at Liverpool.

18 Ibid., 23 March 1844, p 143.

19 Ibid., 6 July 1844, p 362.

20 By late in the 1850s the traffic using the eight stations from Maisons to Mantes was almost as great as that using the two stations at Rouen and almost as great as all that using all the stations on the line from Rouen to LeHavre. See for example the table "II. Trafic par gare", in Journal des Chemins de Fer, 1857, pp 44-45.

21 Complete operating accounts for the three railway companies covering the period up to the end of 1854 are contained in the Appendixes numbered V, VI and VII; beginning in 1855 these companies were merged with the new Cie des Chemins de fer de l'Ouest.

22 Various reports to shareholders of the Paris-to-Rouen company and the Rouen-to-LeHavre company.

23 The dispute was over the arrangement of the tracks connecting the Gare des Batignolles with the main line, owned by the Paris-to-St.-Germain railway. The details of the dispute are summarized in the Journal des Chemins de Fer, 10 February 1844, p 64.

24 The concession "est un contrat par lequel un entrepreneur, en se chargeant d'exécuter, en totalité ou en partie, des ouvrages destinés à l'usage du public, reçoit comme rémunération, au lieu du paiement du prix des travaux, le droit de les exploiter en percevant des taxes sur ceux qui les utiliseront. Une compagnie de chemin de fer exploite donc temporairement une voie dépendant du domaine public....", Clément Colson, Abrégé de la Législation des Chemins de Fer et Tramways, (Paris, 2nd edition, 1903), p 24.

The essential nature of this contract is brought out in Article 35 of the cahier des charges for the Paris-to-Rouen: "Pour indemniser la compagnie des travaux et dépenses qu'elle s'engage à faire par le présent cahier des charges, et sous condition expresse qu'elle en remplira exactement toutes les obligations, le Gouvernement lui concède pour le laps de quatre-vingt-dix-neuf ans, à dater de la loi qui ratifiera, s'il y lieu, la concession, l'autorisation de percevoir les droits de péage et les prix de transport ci-après déterminés...."

25 Arch. Nat. Fl4.9435, Prefect Seine-Inférieure to Sous-secrétaire d'Etat des Travaux Publics, 6 July 1843.

26 Loc. cit.

27 Ibid., Sous-secrétaire d'Etat to Prefect, 25 July 1843.

28 Ibid., Minister of Public Works to Prefect, 14 September 1843.

29 Ibid., Petitions of 29 July, 25 August, and 31 August 1843.

30 Ibid., Chambre of Commerce of Rouen to Prefect, 26 September 1843.

31 Ibid., Paris-to-Rouen railway company to Sous-secrétaire d'Etat, 28 August 1843.

32 Ibid., Paris-to-Rouen railway company to Prefect, 26 September 1843.

33 Ibid., Sous-secrétaire d'Etat to Paris-to-Rouen railway company, 9 September 1843.

34 Ibid., Paris-to-Rouen railway company to Sous-secrétaire d'Etat, 12 September 1843.

35 Ibid., Paris-to-Rouen railway company to Sous-secrétaire d'Etat, 30 September 1843.

36 Ibid., Minister of Public Works to Paris-to-Rouen railway company 3 October 1843.

37 Ibid., Paris-to-Rouen railway company to Minister of Public Works, 12 September 1843.

38 Ibid., Prefect of Police to Minister of Public Works, 9 October 1843.

39 Ibid., Report to Minister of Public Works by the Sous-secrétaire d'Etat, 24 January 1844.

40 Ibid., Prefect of Police to the Minister of Public Works, 17 April 1844.

41 Extrait des procès-verbaux des conseils généraux de l'agriculture, des manufactures et du commerce. Session 1845-1846. Rapport fait au nom de la Commission des Chemins de fer et de la Navigation de la Seine par M. Pauwels, séance du 14 janvier 1846, (Rouen, n.d.).

42 Ordinance of 15 November 1846; see Alfred Picard, Les Chemins de Fer français, (Paris 1884), vol. 1, pp 571-574.

43 Journal des Chemins de Fer, 21 February 1846, p 153.

44 Ordinance of 6 April 1847; see Picard, op. cit., p 605. This ordinance established the Commission générale des chemins de fer; it was composed of four committees, the Section des tracés, the Section de l'exploitation sous le point de vue technique, the Section de l'exploitation sous le point de vue commerciale, and the Section des règlements. This set of committees replaced the earlier Commission supérieure and Commission administrative des chemins de fer, established by ordinances of 22 June 1842; see Bulletin des Lois, ser. 9, vol. 25 (1842), pp 96-100.

45 The Chambre of Commerce in Rouen complained to the Minister of Public Works that it was no longer being consulted before approval of railway tariffs; Arch. Nat. F14.9435, CC Rouen to Minister of Public Works, 7 June 1847.

46 Ibid., Chemin de fer Paris à Rouen. Tarif des marchandises transportées à Petite Vitesse, 12 September 1843.

47 Journal des Chemins de Fer, 23 September 1843, p 690.

48 From weekly reports in ibid.

49 This is a generous estimate; goods carried in September and October 1843 were 3,008 and 3,332 tons respectively. Edmond Teisserenc, "Les canaux et les chemins de fer", Revue indépendante, vol. 15 (1844), p 584.

50 Ch. Collignon, Du concours des canaux et des chemins de fer et de l'achèvement du canal de la Marne au Rhin, (Paris 1845), p 273.

51 Arch. Nat. Fl4.9435, Petition from commissionnaires de roulage to the Prefect of the Seine-Inférieure, 29 July 1843.

52 Journal des Chemins de Fer, 25 May 1844, p 272.

53 The petition referred to above in note 51, signed by five commissionnaires de roulage, Malcouronne, Boursier, C. Duchemin, Huet et Lapoigneux, and Lasseur et Félix Larget.

54 Arch. Nat. Fl4.9435, Petition from the same five petitioners to the Prefect, 25 August 1843.

55 Ibid., Petition from the same to the Conseil-général de la Seine-Inférieure.

56 Journal des Chemins de Fer, 25 May 1844, p 272.

57 Arch. Nat. Fl4.9435, Prefect to the Minister of Public Works, 15 October 1845.

58 Journal des Chemins de Fer, 25 May 1844, p 272.

59 Ibid., 13 July 1844, p 377.

60 Ibid., 13 July 1844, p 395.

61 Journal des Chemins de Fer, 25 May and 13 July 1844.

62 Details of this case are given in ibid., 3 and 10 January 1846.

63 Arch. Nat. Fl4.9436, "Rapport de l'inspecteur de l'Exploitation Commerciale des Chemins de Fer du 2e Arrondissement", 24 August 1849.

64 Quoted in record of "L'Enquête sur l'application des tarifs des chemins de fer—faite en 1850 par le Conseil d'Etat", contained in the Annuaire officiel des chemins de fer, ed. Petit de Coupray, (Paris 1855), p 387.

65 The sources of the figures in Table 9 are as follows. For the traffic by river, the "Note" by Michal dated 27 May 1853, in Arch. Nat. Fl4.6814; for the traffic by rail, the same source

except for 1844, for which more reliable figures seem to be given in the Report to shareholders of the Paris-to-Rouen company of 23 July 1846. Goods by rail include only 'petite vitesse'. A detailed breakdown of commodities carried by river is given in Appendix III; unfortunately there are no equivalent figures for the railway.

66 From a letter of 12 September 1844, quoted in Ch. Collignon, op. cit., pp 104-05.

67 Water-borne transport rates are given in Michal, "Note", in Arch. Nat. Fl4.6814, 27 May 1853; see Table 4 in Chapter Three.

68 Arch. Nat. Fl4.9435, Paris-to-Rouen railway company to Minister of Public Works, 3 February 1844, attachment "Modifications au projet de tarifs des Marchandises de Petite Vitesse", and Journal des Chemins de Fer, 24 February 1844.

69 Edmond Teisserenc, Etudes sur les voies de communications perfectionnées et sur les lois économiques de la production du transport, (Paris 1847), p 81.

70 Arch. Nat. Fl4.9435, Ordonnance du Prefet de Police, 16 August 1844.

71 Ibid., Prefect of the Seine-Inférieure to Minister of Public Works, 15 October 1845.

72 Ibid., Chambre of Commerce of LeHavre to Minister of Public Works, October 1845 and CC Rouen to Minister, 20 November 1845; see also résumé given by the Prefect in a letter to the Directeur-général des Ponts et Chaussées on 22 November 1845.

73 Germonière, Chambre de Commerce de Rouen. Rapport sur la question relative au transport des marchandises par la compagnie du chemin de fer de Rouen à Paris, (Rouen 1845).

74 Extrait des procès-verbaux des Conseils-généraux de l'Agriculture, des Manufactures et du Commerce. Session 1845-1846. Rapport fait au nom de la Commission des Chemins de fer et de la navigation de la Seine par M. Pauwels, séance de 14 janvier 1846, (Rouen n.d.), p 4.

75 Arch. Nat. Fl4.9435, Directeur-général des Ponts et Chaussées to Prefect, 26 December 1845.

76 See for example agreement by LeNormand-Baudu and a certain Darblay of Paris for transport 'à forfait' between 15 December 1846 and 30 June 1847, cited in Le Moniteur de la Marine, 16 February 1850.

77 Journal des Chemins de Fer, 24 January 1846, p 64; and evidence given by Grandin, député for Elbeuf, in the Chambre de députés on 3 March 1846, in Le Moniteur Universel, 4 March 1846, p 543.

78 Le Moniteur de la Marine, 9 February 1850; a verbal agreement was made between these companies on 25 March 1846.

79 The bateliers sued the railway company for 600,000 F damages and were awarded 90,000 F plus costs in August 1846; Journal des Chemins de Fer, 4 July and 8 August 1846, pp 505, 695.

80 Vauquésal-Papin, "De Rouen au Havre. Le chemin vers la mer...1843-1847", La vie du Rail, NO. 1029 (January 1968), p 10.

81 This is a very rough estimate, derived from various figures given in Reports to shareholders of the Rouen-to-LeHavre company. In its first year of operation the Rouen-to-LeHavre railway carried a total of 186,132 tons of 'petite vitesse' goods in both directions.

82 Chambre de commerce de Rouen, Statistiques du Commerce maritime du port de Rouen de l'année 1843 à 1867, (Rouen 1844-1867), 1846, 1847.

83 Arch. Nat. F12.7600, Letter from CC Rouen to the Minister of Agriculture and Commerce, 24 June 1848, in reply to the Minister's Circular of 3 June 1848 concerning the state of the local economy.

84 Le Moniteur de la Marine, 23 July 1848.

85 Ibid., 9 February 1850.

86 Ibid., 6 September 1848.

87 Ibid., 4 August 1849.

88 Archives départementales de la Seine-Maritime, Series S, Navigation, statistiques des bateaux à vapeur naviguant sur les fleuves (1835-1850), and a second liasse for 1851 to 1860.

89 Expert et Vieillard, Remorquage. Seine maritime, (LeHavre 1852), and by the same authors, Remorquage. Basse Seine, (LeHavre 1853).

90 Chambre de commerce de Rouen, op. cit., 1847, 1850.

91 Le Moniteur de la Marine, 20 September 1848; statement by Louis d'Artois, editor of the Moniteur.

92 Counts of boats and their owners were made from weekly lists of arrivals in Paris given in Le Moniteur de la Marine.

93 Ibid., 19 February 1854.

94 The sources for these graphs are the Reports to shareholders of the Paris-to-Rouen and Rouen-to-LeHavre railway companies, each of which contained a financial report; all references to company financial results in the following pages are taken from the same sources.

95 Railway costs can in general be broken into long-run fixed costs associated with capital (interest and amortization payments), and operating costs. Within the latter there is a fixed cost component (the size of which varies according to the time horizon

being considered), and a variable component dependant entirely upon the volume of traffic carried. This can be reduced to the following functional relationship:

$$Y = a + bX$$

Where Y = total operating costs; a = fixed operating costs; and b = variable cost per unit carried. The argument in the text is that while goods more than paid for the component 'b' directly incurred by their carriage, and that they contributed toward defraying 'a', their contribution to 'a' was proportionately smaller than their share of total revenues. If rates had been based entirely upon fully allocated cost, rather partly upon competitive considerations, then these proportions should have been approximately equal.

An attempt has been made to determine in a very rough manner the parameters 'a' and 'b' in the above function for the Paris-to-Rouen railway. Unfortunately the data available in the accounts of the company and elsewhere are much too few to enable one to make any accurate calculations. Modern railway costing is based upon regression analysis, and a much simplified version of this has been used in what follows. Using the data available in the Reports to Shareholders of the Paris-to-Rouen company, a simple cost function was developed; it is a modification of the simple linear function above:

$$Y = a + bX + cZ$$

Where Y = total operating costs; a = fixed operating costs; b = variable cost per unit X of passengers; and c = variable cost per unit Z of goods. Note that the data used expresses goods and passengers in simple tons and numbers carried, and not in ton-kilometres or passenger-kilometres. Regressing X and Z on Y, the following equation was obtained:

$$Y = 1,300,000 + 1.0 \cdot X + 3.1 Z \quad (R^2 = 0.46)$$

In other words, fixed operating costs were approximately 1.3 MF; these costs would have been incurred even if the line were closed down for a short time. The average passenger carried added 1 F to company costs, and the average ton of goods added 3 F.10. Taking the first half of 1847 as an example, the direct variable costs of carrying approximately 506,000 passengers and 164,000 tons of goods was 1,016,000 F. Total revenues from these two sources were 4.65 MF, of which 1.9 MF (41%) from goods and 2.75 MF (59%) from passengers. After meeting variable costs the total amount from both sources left to meet fixed operating costs and the costs of interest and amortization was 3.65 MF, to which goods revenues contributed only 26% and passenger revenues 74%.

96 Journal des Chemins de Fer, 20 May 1843, p 542.

97 Meeting of shareholders of the Paris-to-Rouen railway company on 8 July 1843, reported in the Journal des Chemins de Fer, 12 August 1843, p 647.

98 The theory of oligopoly has been extensively explored by numerous authors. A very interesting summary article was published recently by Delbert M. Steiner: "Monopolistic Competition Pricing Strategy and Intermodal Competition", in The Transportation Journal, vol. 7, NO 1 (Fall 1967), pp 15-20.

99 Report to shareholders of the Paris-to-Rouen railway company, 23 July 1846, Journal des Chemins de Fer, 25 July 1846, p 637.

100 Figures 16, 17 and 19 have been drawn after making series of calculations based upon actual financial results of the Paris-to-Rouen and the Rouen-to-LeHavre railway companies.

101 Report to shareholders of the Rouen-to-LeHavre railway company, 30 September 1847, ibid., 2 October 1847, p 745.

102 Report to shareholders of the Rouen-to-LeHavre railway company, 30 March 1850, ibid., 6 April 1850, p 259.

103 Monthly cost and revenue figures for March to August 1848 are contained in the report to shareholders of the Rouen-to-LeHavre railway company of 30 October 1848, ibid., 4 November 1848, p 406.

104 Report to shareholders of the Rouen-to-LeHavre railway company, 30 September 1847, ibid., 2 October 1847, p 745.

105 Ibid., 15 May 1847, p 372, reprinted from the Courrier du Havre. The slow service was attributed to a shortage of rolling stock.

106 Report to shareholders of the Rouen-to-LeHavre railway company, 30 September 1847, ibid., 2 October 1847, p 745.

107 Report to shareholders of the Rouen-to-LeHavre railway company, 30 October 1848, ibid., 4 November 1848, p 406.

1 See an eye-witness report of progress in constructing the projects at Bezons and Marly in Le Journal de l'industriel et du capitaliste, vol. 5 (1839), pp 282-290.

2 Arch. Nat. Fl4.6816, Dossier du 1842, containing a note by Michal dated 2 May 1839.

3 Arch. Nat. Fl4.6814, Report by Michal on projects for improvements at Maisons and Andrézy. dated 27 February 1840.

4 Arch. Nat. Fl4.*10912.103, Procès-verbal du Conseil-général des Ponts et Chaussées, session of 28 July 1842, report on the public inquiries held in Paris, Versailles, Rouen and LeHavre in 1841.

5 Arch. Nat. Fl4.6814, Report by Michal, dated 27 February 1840.

6 Arch. Nat. Fl4.*10912.103, op. cit.

7 Ministère des Travaux Publics, Direction général des Ponts et Chaussées et Mines, Situation des Travaux, 1838.

8 This has been described as a real budgetary revolution; see Marcel Marion, Histoire financière de la France depuis 1715, (Paris 1914-31), vol. 5, p 190.

9 Arch. Nat. Fl4.6815, Travaux proposés par M. Bleschamps, en amont de Rouen, 31 July 1840.

10 Arch. Nat. Fl4.6814, Rapport sur les travaux projetés pour perfectionner la navigation de la Seine depuis l'embouchure de l'Oise jusqu'à Paris, 8 February 1841, signed Poirée.

11 See Situation des Travaux, op. cit., 1840.

12 Arch. Nat. Fl4.*10912.101, Procès-verbal du Conseil-général des Ponts et Chaussées, session of 10 April 1841, Avis du Conseil.

13 Arch. Nat. Fl4.*10912.103, Procès-verbal du Conseil-général des Ponts et Chaussées, session of 28 July 1842, report on results of public inquiry.

14 Arch. Nat. Fl4.6814, Rapport sur les travaux indiquées par la lettre de M. le Sous-Secrétaire d'Etat des travaux publics en date de 20 novembre 1841, signed Bleschamps, 2 December 1841.

15 Arch. Nat. Fl4.*10912.103, op. cit.

16 Arch. Nat. Fl4.*10912.106, Procès-verbal du Conseil-général des Ponts et Chaussées, session of 30 November 1843.

17 It is possible that the lack of attention given to proposals made in 1840 for improvements to the 4e Section was partly owing to the somewhat withdrawn character of Bleschamps. He was not an ambitious man, was said to have "un goût prononcé pour l'isolement", and a personality which "peut être un peu bizarre". He stayed in

his post in the Service de la Navigation de la Seine for only three years, and was then transferred to a less important post in the Pyrénées-Orientales. His 'dossier de personnel' indicates that perhaps he did not get on well with his colleagues. An inspecteur in 1850 reported: "Homme probe et juste; vic d'isolement; indifférence pour les progrès et les améliorations;.. en somme, peu d'action et initiative, malgré de fréquentes tournées pédestres; service qui peut paraître insuffisant." That this assessment was a superficial one, resting more upon his personal eccentricities. When the improvements on the Seine-Maritime had been underway for some time, another inspecteur reported: "M. Bleschamps est trop modeste, il ne recherche jamais à se faire valoir; mais c'est certainement un homme de beaucoup d'esprit, d'intelligence, d'une grande loyauté. Il fait et il a toujours fait son service avec zèle, avec conscience. Dans son bureau jamais d'affaires en retard. Le projet exécuté avec succès pour l'amélioration de la Seine maritime est dû à M. Bleschamps." See Arch. Nat. F14.2173.1.

18 Arch. Nat. F14.*10912.103, Procès-verbal du Conseil-général des Ponts et Chaussées, session of 28 July 1842.

19 Arch. Nat. CC.399.1836, Ponts et Chaussées, 4e Section, 1843. "Mémoire à l'appui des projets d'amélioration de la Basse Seine", signed Adée Méry, 14 December 1843.

20 In fact Doyat was appointed ingénieur-en-chef for the département of the Seine-Inférieure, replacing Pierre Frissard, who was promoted to inspecteur-général and given a place on the Conseil-général des Ponts et Chaussées. However, during the next ten years Doyat took personal charge of the project to improve the Seine-Maritime. See Arch. Nat. F14.2215.1, dossier personnel of Doyat.

21 Arch. Nat. F14.6814, Report by Cavenne, Devilliers and Fevre on the Basse Seine, 1 April 1843.

22 Ibid., Navigation de la Seine. Procès-verbal de Conférence. 16 July 1843. Meetings took place at Evreux on May 13th and at Paris on June 6th.

23 Ibid., Projet d'ensemble...3e Section, signed Michal, 30 June 1843. See also CC.399.1836, for detailed drawings.

24 Arch. Nat. CC.399.1836, Mémoire signed by Méry, op. cit., 14 December 1843.

25 Arch. Nat. F14.6816, Dossier of 1843, "Importance et Avenir de la Navigation de la Seine", signed Michal, 14 April 1844.

26 Arch. Nat. F14.*10912.109, Procès-verbal du Conseil-général des Ponts et Chaussées, session of 20 February 1845. Specifically the projects approved for the Basse Seine were:

- (1) a dérivation at Epinay
- (2) a dérivation at Andrésy
- (3) a dérivation at Giboin (Mézy)
- (4) a dérivation at Goulet (Port-Mort)
- (5) a dérivation at Poses
- (6) a dérivation without locks or dams
at the bras de Freneuse.

TOTAL estimated cost for dérivations... 6,211,397 F.

(7)	tow paths	1,724,955
(8)	dredging	817,485
(9)	arches marinières	740,000
(10)	strengthening of river banks	396,015
	contingencies and indemnities ..	609,648

TOTAL 10,500,000 F.

27 Pierre Frissard, Navigation fluviale du Havre à Paris. Amélioration de la navigation du Havre à Rouen, (LeHavre 1832).

28 Details of its contents are given in Arch. Nat. CC.399.1836, report by Doyat, dated 28 March 1844.

29 In 1844 Poirée presented to public inquiries held in that year another plan which differed substantially from that of Bleschamps; see "Mémoire de M. Poirée", 10 November 1844, in Chambre de commerce de Rouen, Enquête sur les travaux à faire pour l'amélioration de la navigation de la Basse Seine, (Rouen November 1844).

30 Chambre de commerce de Rouen, Rapports sur les questions relatives à l'amélioration de la Seine et sur la proposition de divers barrages, (Rouen 1837).

31 Arch. Nat. F12.7599, letter from CC Rouen to Minister of Public Works, 3 February 1844.

32 Chambre de commerce de Rouen, Amélioration de la Basse-Seine. Observations de la Chambre de commerce de Rouen, (Rouen 16 February 1844).

33 Arch. Nat. CC.399.1836, report by Doyat, 28 March 1844; see also Bouniceau, Etude sur la navigation des rivières à marées, (Paris 1845), and Etudes et notions sur les constructions à la mer, (Paris 1866). Bouniceau had been responsible for the design of the first successful project of this kind in France in the Baie des Veys, the estuary of the rivers Aure and Vire at Isigny. The only other similar project completed at that time was on the Clyde.

34 The documentation relevant to this inquiry, together with the reports it made, were published by the Chambre of Commerce of Rouen in Enquête sur les travaux à faire pour l'amélioration de la Basse-Seine, (Rouen November 1844).

35 Chambre de commerce du Havre, Examen des projets d'amélioration de la Seine maritime, (Paris 1845); and Rapport de la Commission chargée d'examiner le projet relatif à l'amélioration de la navigation de la Basse-Seine, (LeHavre 30 October 1844), in Archives de la ville du Havre, 03.3.

36 Arch. Nat. F14.*10912.109, Procès-verbal du Conseil-général des Ponts et Chaussées, session of 3 March 1845.

37 Procès-verbaux de la Chambre des députés, Session 1845, vol. 3, NO. 39, pp 25ff.

38 Ibid., Session 1845, vol. 9, NO. 169, pp 15ff.

39 Report of the committee examining the project for the canal de la Marne au Rhin, Le Moniteur universel, 1844, p 1960. Arising out of the controversy over this canal there were several books and articles published arguing the general case for railways and for waterways. The most important of these (for waterways) was a book by Ch. Collignon, Du concours des canaux et des chemins de fer et l'achèvement du canal de la Marne au Rhin, (Paris 1845); and (for railways) Edmond Teisserenc, "Les canaux et les chemins de fer", Revue indépendante, vol. 15 (1844), pp 131-150; see also the book by Teisserenc, Etudes sur les voies de communications perfectionnées et sur les lois économiques de la production du transport, (Paris 1847).

40 Le Journal des Chemins de Fer, 25 May 1844, p 272.

41 Henry Maillet Duboullay, A la commission chargée d'examiner le projet de loi sur la navigation intérieure..., (Rouen n.d.), contained in Archives de la ville du Havre, 03.3.

42 Arch. Nat. F12.7599, see petitions and letters to the Minister of Agriculture and Commerce from the Chambres of commerce of La Rochelle, Cherbourg, and St.-Brieuc, and from Les Armateurs et Propriétaires de Navires, Capitaines et Maîtres au Cabotage du Port de St.-Vaast la Hougue (Manche).

43 Arch. Nat. CC.2210, NO. 240, petition to the Chambre des députés from the "Electeurs, propriétaires et commerçants" of the Seine-Inférieure, dated Rouen 12 February 1845.

44 Chambre de commerce de Rouen, Etat des économies que la navigation de la Basse-Seine devra éprouver si les améliorations projetées ont lieu, comparatives aux dépenses qu'elle a à supporter dans l'état actuel des choses, (Rouen 22 February 1845).

45 See for example letter from the Minister of Commerce to the Chambre de commerce de St.-Brieuc, 20 August 1845, Arch. Nat. F12.7599.

46 The committee's other members were Renaud (ingénieur-en-chef, in charge of ports in the dép. of Seine-Inférieure), and Tostain (ingénieur-en-chef, dép. du Calvados); report in Doyat, Ponts et Chaussées. Amélioration de la Basse-Seine. Rapport au Ministre des Travaux Publics..., (Rouen 26 January 1846.)

47 See Arch. Nat. F14.6817, CC Rouen to Sous-secrétaire d'Etat des travaux publics, 13 December 1845, containing the attachment by Rondeaux, Rapport à la Chambre de Commerce de Rouen sur l'amélioration de plusieurs rivières et ports à marées d'Angleterre et d'Ecosse (12 December 1845)..., (Paris 1846).

48 Chambre de commerce de Rouen, Amélioration de la Seine Maritime, (Rouen August 1845).

49 Le Moniteur universel, 4 March 1846, p 543.

50 Bulletin des Lois, ser. 9, vol. 32 (1846), pp 389-393.

51 Louis Girard, La Politique des Travaux Publics du Second Empire, (Paris 1952), p 155.

52 Arch. Nat. F12.7599, letter from CC Rouen to Minister of Public Works, 14 March 1847.

53 See Tudesq, Les Grands Notables en France (1840-1849), (Paris 1964), vol. 2, pp 955-956. For some months the City of Rouen had been very concerned about the large and growing number of unemployed workers in the region; with the aid of 33,000 F from the central government and a municipal loan, the City had opened some of its own public works projects in March 1847.

54 Arch. Nat. F14.*10912.115, Procès-verbal du Conseil-général des Ponts et Chaussées, 28 February 1848. The project approved included a dyke on the left shore of the river from the Ile de Belcinac, opposite Villequier, to a point near Vacquerie, and a number of épis or jetties on the right shore; the latter were subsequently changed to dykes.

55 Arch. Nat. F12.7599, letter from CC Rouen to Minister of Public Works, 3 October 1848. There is evidence that pressure was put upon the Ponts et Chaussées engineers supervising the work to hire the greatest possible number of unemployed workers; Archives départementales de la Seine-Maritime, Series S, Navigation de la Seine, amélioration, affaires diverses, letter from engineer in charge of construction works to Commissaire de la République in Rouen, 2 June 1848.

56 Arch. Nat. F12.7599, letter from CC Rouen to Minister of Public Works, 3 October 1848; and Chambre de commerce de Rouen, Exposé des Travaux, (Rouen 1846-1868), section for 1847-48.

57 Arch. Nat. F14.*10912.117, Procès-verbal du Conseil-général des Ponts et Chaussées, session 26 March 1849.

58 Archives départementales de la Seine-Maritime, Series S, Navigation de la Seine, amélioration, affaires diverses, letter from Minister of Public Works to Prefect of Seine-Inférieure, 4 July 1849.

59 Arch. Nat. F14.*10912.119, Procès-verbal du Conseil-général des Ponts et Chaussées, session of 30 May 1850. The proposal sent to the public inquiries included the following:

La Mailleraye to Villequier dykes	930,000
dredging of Banc des Meules	100,000
tow path on left shore La Mailleraye to Caudebec	560,000
TOTAL	1,590,000 F
Quillebeuf to Tancarville dyke, right shore	1,872,000
Quillebeuf to Pointe de La Roque dyke, left shore	2,148,000
contingencies	480,000
TOTAL	4,500,000 F

60 Chambre de commerce de Rouen, Enquête sur deux projets d'endiguement de la Seine Maritime...arrêté de M. le Ministre des Travaux Publics du 16 Juillet 1850, (Rouen August 1850).

61 Chambre de commerce de Rouen, Endiguement de la Seine-Maritime. Procès-verbaux et autres documents de l'enquête..., (Rouen 1851).

62 Ibid., p 139, letter from CC Rouen to Prefect, 31 October 1850.

63 Procès-verbaux de la Chambre de Commerce du Havre, vol 24, session of 30 December 1850. The phrase "l'esprit d'égoïste rivalité qui avait dicté le projet de continuer l'endiguement" was removed from a report by a member of the Chambre to conform with the President's wishes; ibid., vol 24, session of 21 February 1851.

64 Chambre de commerce de Rouen, Endiguement..., (Rouen 1851), p 18.

65 Procès-verbaux de la Chambre de Commerce du Havre, vol 24, session of 21 February 1851; and vol 25, session of 28 March 1851.

66 Ibid., vol. 25, session of 9 May 1851.

67 The decree of 1852 gave 800,000 F for dredging of the Banc des Meules, for a dyke of 5,130 m. on the right shore from La Mailleraye to Caudebec and for a dyke of 3,380 m. on the left shore from Villequier to Caudebec; it also gave 2 MF for a dyke on the right shore from Quillebeuf to Tancarville. Archives départementales de la Seine-Maritime, Series S, Navigation de la Seine, dossiers du Conseil général (1856-1869), Report to the Prefect by the Engineer in chief of the 4e Section, 1856.

68 The State also received about 1,290,000 F for the land created behind the dykes, which very quickly became useful agricultural land; ibid., report of the engineer in chief of the 4e Section to the Prefect, 29 July 1859.

69 Chambre de commerce de Rouen, Avantages et économies résultant de l'endiguement de la Seine-Maritime, (Rouen December 1859).

70 Archives départementales de la Seine-Maritime, Series S, Navigation de la Seine, dossiers du Conseil général (1856-1869), report by the engineer in chief of the 4e Section to the Prefect, 26 July 1861. Expenditures made on improvements to the Seine-Maritime up to 1 July 1859 were:

Tow paths from Rouen to La Mailleraye	.....	1,493,412
Tow paths and dykes from La Mailleraye to Villequier	.....	667,795
Dykes from Villequier to Quillebeuf	.....	2,913,760
Dykes from Quillebeuf to Tancarville and La Roque	.....	4,410,207
TOTAL	.....	9,485,176 F

The total funds authorized for these projects was 9.8 MF.

Further improvements were undertaken during the 1860s, the dykes being extended further out into the bay. Construction of dykes and a canal from inside the harbour at LeHavre to Tancarville have been carried out during the late nineteenth and the twentieth century. A good summary of modern improvements to the Seine-Maritime has been written by Monique Dumans, in "Contribution à l'Etude de la Navigation en Basse-Seine", Etudes Normandes, NO. 85 (1957).

71 Arch. Nat. Fl4.7599, letter from CC Rouen to Minister of Agriculture and Commerce, 18 July 1846; this letter was sent on to the Minister of Public Works on the 10th of August 1846.

72 Archives départementales de la Seine-Maritime, Series S, Navigation de la Seine, dragages.

73 Arch. Nat. Fl4.6814, Navigation de la Seine, 3e Section, Tableau récapitulatif des dépenses..., 6 July 1858, signed Féline Romany, ingénieur en chef.

74 Le Moniteur de la Marine, 3 November 1849.

75 Situation des Travaux, op. cit., 1846.

76 Ministère des Travaux Publics, Direction général des ponts et chaussées et des chemins de fer, Documents statistiques sur les routes et les ponts, (Paris 1873), Table 12.

77 Le Moniteur de la Marine, 3 November 1849.

78 Ibid., 25 March 1855.

79 The six locks were at Marly, Andrésey, Notre Dame de la Garenne, Poses, Pont de l'Arche and Meulan. The nine dams were at Meulan and Bezons, two each at the dérivations at Andrésey and Goulet, and three at Poses. The amounts spent on the Basse Seine up to the 31st of December 1857, when funds from the law of 31 May 1846 were exhausted were as follows:

Tow paths	1,657,039 F
Dredging	1,741,738
Arches marinières	805,518
Dérivations	5,619,900
Other	455,283
 TOTAL	 10,279,488

From Arch. Nat. Fl4.6814, Navigation de la Seine, 3e Section, Tableau récapitulatif des dépenses..., 6 July 1858, signed Féline Romany, ingénieur en chef. These figures include the cost of all improvements from Paris to Rouen; during the 1850s the dividing point between 3e and 4e Sections de la Seine was moved from Notre Dame de la Garenne to Rouen.

80 See Ernest Grangez, Précis historique et statistique des voies navigables de la France et d'une partie de la Belgique, (Paris 1855), p 631.

81 Arch. Nat. F14.6815, Rapport de l'ingénieur en chef directeur, 24 February 1855, signed Michal.

82 Ibid., and Arch. Nat. F14.*10912.131, Procès-verbal du Conseil-général des Ponts et Chaussées, session of 23 June 1856. During the decade the idea of a maritime canal was revived, and several requests for concessions of such a canal. None was very realistic financially, or technically. Nevertheless more than one of them was looked at in some detail by the Conseil-général des Ponts et Chaussées.

83 Le Moniteur de la Marine, 10 July 1859, reported a paper given by Barral to the Académie des Sciences in 1858, which stated that during 1858 the Seine had fallen to a level lower than any since 1732.

84 Ibid., 14 March 1858 and 3 April 1859. Also Arch. Nat. F14.6814, Report of the chief engineer of the 3e Section to the Minister of Public Works, 12 July 1858, for reference to another petition.

85 Ibid.

86 Le Moniteur de la Marine, 24 July 1859.

87 Le Moniteur Universel, 15 January 1860, letter from the Emperor of 5 January 1860. See Girard, op. cit., pp 241 ff.

88 Le Moniteur de la Marine, 30 October 1859.

89 Ibid., 3 September 1861.

90 See Jean Aubert, Barrages et canalisations, (Paris 1949), pp 418-419; and Lucien Morice, Les transports fluviaux, (Paris 1968), pp 28-29.

1 Frédéric De Coninck, LeHavre, son passé, son présent, son avenir, (LeHavre 1857), part entitled "Revue pour 1849", p 154.

2 De Coninck, Revue pour 1852, (LeHavre 1853), p 156.

3 Archives départementales de la Seine Maritime, Series M, Chambre de Commerce du Havre. Courtiers, agents de change. 1817-1857. "Rapport fait à la Société Havraise d'Etudes diverses, le 24 juin 1853, sur l'écrit de M. Delaunay", by Millet-Saint-Pierre, quoting from a petition by the Chambre of Commerce of LeHavre to the Minister of Commerce in 1849, p 21.

4 Alphonse Joanne, Atlas historique et statistique des chemins de fer français, (Paris 1859), pp 18-19.

5 Report to shareholders of the Paris-to-Rouen railway company, meeting of 31.I.1849, Journal des Chemins de Fer, 3.II.1849, p 70.

6 Report to shareholders of the Paris-to-Rouen railway company, meeting of 30.I.1850, in ibid., 2.II.1850, p 73.

7 These have been determined from company accounts, which are given in full in Appendix V. The 'operating ratio' (coefficient d'exploitation) is the operating expenses to operating revenues.

8 Report to shareholders of the Paris-to-Rouen railway company, meeting of 31.I.1849, ibid., 3.II.1849, p 70.

9 Report to shareholders of the Paris-to-Rouen railway company, meeting of 30.I.1850, ibid., 2.II.1850, p 73.

10 Report to shareholders of the Paris-to-Rouen railway company, meeting of 31.VII.1851, ibid., 2.VIII.1851, p 533.

11 Procès-verbaux des séances de la Chambre de commerce du Havre, vol. 20, 20.III.1848 and vol. 29, 27.II.1857.

12 Ibid., vol. 27, 11.II.1853.

13 Edouard Boinvilliers gives a very good summary of the several kinds of price discrimination in use during this period in his book Des transports à prix réduits sur les chemins de fer, vol. 2 of Etudes politiques et économiques, (Paris 1863).

14 Le Moniteur de la Marine, 27.XI.1853.

15 Ibid., 20.V.1854 and 1.VI.1854.

16 Ibid., 22.II.1857.

17 Arch. Nat. F14.9436, Report by the Directeur-général des chemins de fer to the Minister of Public Works, 11.VIII.1854.

18 There were some, like the engineer-political economist J. Dupuit, who argued that price discrimination was theoretically correct. See J. Dupuit, "De la mesure de l'utilité des travaux publics", Annales des Ponts et Chaussées, (1844.2), and by the same author, "Péages: leur influence sur l'utilité des voies de communication", ibid., (1849.1), pp 170-248.

19 Procès-verbaux des séances de la Chambre de commerce du Havre, vol. 26, 16.I.1852.

20 Ibid., vol. 26, 14.IV.1852, 14.V.1852.

21 "L'Enquête sur l'application des tarifs des chemins de fer—faite en 1850 par le Conseil d'Etat", in Annuaire officiel des chemins de fer, ed. Petit de Coupray, (Paris 1855), p 333.

22 Ibid., p 336.

23 Le Moniteur de la Marine, 29.VI.1850.

24 P.-A. Dutard, Mémoire sur l'application des tarifs des chemins de fer, (Paris 1856), pp 79, 62.

25 Le Moniteur de la Marine, 27.X.1850.

26 Ibid., 1.VI.1850.

27 Ibid., 3.XI.1849.

28 Loc. cit.

29 See ibid., 8.IV.1855.

30 See Louis Girard, la politique des Travaux Publics du Second Empire, (Paris 1952), p 69.

31 Le Moniteur de la Marine, 6.VIII.1848.

32 A count of boats was made from the weekly listings of arrivals at LaBriche contained in the Moniteur de la Marine, for 1848 and 1850.

33 This has also been determined from the weekly listings cited in note 32.

34 Le Moniteur de la Marine, 6.VIII.1848.

35 Le Moniteur de la Marine, 23.VII.1848; Louis d'Artois stated that it was competition among the bateliers which had forced the rates down.

36 Ibid., 20.IX.1848.

37 Le Moniteur de la Marine, sponsored by the Syndicate published its first issue on 18.VI.1848. The president of the Syndicate was Paul de Hercé.

38 The formation of the "Association des bateliers du Nord" was announced in Le Moniteur de la Marine of 18.VIII.1849.

39 Ibid., 11.X.1848.

40 Its formation was announced in ibid., 15.VIII.1852; Blanchet, director of the Société générale des remorqueurs parisiens was president, MM. Férez, Poulain, Dantan and Leduc elected members. More details about the association are given in ibid., 29.VIII.1852.

41 Arch. Nat. F14.* 11039, Procès-verbal de la Section de la Navigation, Conseil-général des Ponts et Chaussées, session of 12 June 1850.

42 See Le Corbeiller, Histoire du port de Rouen et de Son Commerce, (Rouen 1902), p 185; H. Wallon, Le Magasin de Sauvetage de Quillebeuf, (Rouen 1902), pp 235-258.

43 See Archives départementales de la Seine-Maritime, Series S, Ports, port du Havre, établissement du Dock, when the city was giving consideration to the so-called Dock Ladvocat project in the late 1830s; and also Series M, Douanes, entrepôts, docks et magasins généraux, arrondissement du Havre (An IX-1860), on the agreement with the Cie Perier in 1844.

44 Procès-verbaux des séances de la Chambre de commerce du Havre, vol. 17, 5.VI.1846.

45 B. Gille, "La Banque du Havre", Annales de Normandie, (1960), a.10, no.1, pp 35-51.

46 The first reference to it is in a proposal made to the Chambre of Commerce in LeHavre at its meeting of 12.III.1850. In its issue of 13.IV.1850 the Moniteur de la Marine reported that Dubois was again interested in the company and so was the railway. In the following week the Moniteur de la Marine reported that the Cie de Mondésir had some time previously "infesté" LeHavre with 8,000 shares, which were now running at only 20 per cent of their par value. 4MF had been subscribed. Charles Laffitte had bought 1,000 shares (500,000F) and the railway had lent the company 1MF.

47 Procès-verbaux des séances de la Chambre de commerce du Havre, vol. 22, 12.III.1850.

48 Le Moniteur de la Marine, 1.VI.1850.

49 In mid-June 1850 there was a very heated exchange of articles in the Journal du Havre (by de Mondésir) and in the Moniteur de la Marine (by Louis d'Artois).

50 Le Moniteur de la Marine, 15.VI.1850.

51 Ibid., 27.VII.1850.

52 Report to the shareholders of the Rouen-to-LeHavre railway company, meeting of 30.IX.1850, in Journal des Chemins de Fer, 5.X.1850, p 703.

53 This innovation was described as a "vindat à double fusée" in a note in the Moniteur de la Marine, 25.II.1851.

54 The patent was taken out by l'Entreprise de Constructions Navales Gâche frères, 21 December 1848: "disposition de bateau à vapeur particulièrement applicable à la navigation sur les rivières canaux et sur les rivières étroites." From alphabetical listings of patents held by the Institut National de la Propriété Industrielle.

55 Le Moniteur de la Marine, 18.IV.1852.

56 Archives départementales de la Seine Maritime, Series S, Navigation, statistiques des bateaux à vapeur naviguant sur les fleuves (1834-1850).

57 Le Moniteur de la Marine, 30.IX.1855.

58 These figures and those in the following table are taken from information given in ibid., 1.IV.1855.

59 Archives départementales de la Seine Maritime, Series S, Navigation de la Seine, dossiers du Conseil général (1856-1869). "Rapport de l'ingénieur chargé de la 3e section de la Seine, to the Prefect of the Seine-Inférieure", 1856.

60 See Le Moniteur de la Marine, and Arch. départementales de la Seine Maritime, Series S, Navigation, statistiques... (1834-1850).

61 Le Moniteur de la Marine, 24.IV.1853; the HELICES were 40 metres by 5 metres, with a draft of 1m.40. The PORTEURS were 39m.50 by 5 metres, with a draft of only 0m.90. Whereas the former could carry up to 200 tons, the latter could carry only 80 to 100 tons. The steam engines on both were small, 20 horse-power for the PORTEURS and 25 for the HELICES. The engines for the latter were built by the Cie Mazeline of LeHavre.

62 Le Moniteur de la Marine, 25.XII.1853, gives the following figures for the four principal rivers of France (in ton-kilometres):

	<u>1849</u>	<u>1850</u>	<u>1851</u>	<u>1852</u>
Seine (Paris-Rouen)	105,195,150	124,185,069	135,257,534	157,487,240
Loire	100,430,364	101,185,123	96,949,294	106,746,044
Rhône	102,580,691	104,895,313	108,525,276	133,502,165
Saône	116,447,062	131,530,961	127,051,029	133,815,663

Whereas traffic on the Basse Seine grew by 50 per cent, that on the Rhône, closest to it in rate of growth during these years, grew only by 30 per cent.

63 Ibid., 9.X.1853.

64 Ibid., 23.VII.1854 and 1.IV.1855.

65 Ibid., 23.VII.1854.

66 Rail traffic between LeHavre and Rouen was consistently bound for Paris in the proportion of about 85 per cent in every year from 1855 to 1860, and similar figures are given in Rouen-to-LeHavre company reports to shareholders during the forties.

67 Data for this table were taken from several sources: from Le Moniteur de la Marine; Chambre de commerce de Rouen, Statistiques de Commerce maritime du port de Rouen, (Rouen 1844-1868); and the Reports to shareholders of the Rouen-to-LeHavre railway company, printed in the Journal des Chemins de Fer.

- 68 Le Moniteur de la Marine, 30.VII.1854 and 1.IV.1855.
- 69 Direction général des Douanes, Tableau général du mouvement du cabotage, (Paris 1845...)
- 70 Chambre de commerce de Rouen, Statistiques du Commerce maritime du port de Rouen..., (Rouen 1855).
- 71 Archives départementales de la Seine-Maritime, Series S, Navigation de la Seine, dossiers du Conseil général (1856-1869), Société libre d'émulation du Commerce et de l'industrie de la Seine-Inférieure, "Rapport fait par Mr. Gaigneux au nom d'une Commission dans la séance du 7 Août 1861".
- 72 Moniteur de la Marine, 8.IV.1855.
- 73 Ibid., 14.III.1858.
- 74 Ibid., 29.VII.1860.
- 75 Ibid., 11.VII.1858.
- 76 Chambre de commerce de Rouen, op. cit., 1853, 1860.
- 77 Table taken from Arch. Nat. AD.XIX, N.87, Documents statistiques sur les chemins de fer, (Paris 1856), Tab. Ag, p cxvi.
- 78 In Reports to the Shareholders of the Chemin de Fer de l'Ouest, contained in the Journal des Chemins de Fer, 1855-60.
- 79 Le Moniteur de la Marine, 23.VII.1854.
- 80 Ibid., 3.IX.1854.
- 81 Archives départementales de la Seine-Maritime, Series S, Navigation, statistiques des bateau à vapeur naviguant sur les fleuves (1851-1860), 1854.
- 82 Ibid., 1856 and 1857.
- 83 See Louis Girard, op. cit., passim.
- 84 Procès-verbaux des séances de la Chambre de commerce du Havre, vol. 30, 7.VII., 4, 10, 19, 26.VIII., 8.IX.1854.
- 85 Félix Rivet, La navigation à vapeur sur la Saône et le Rhône (1783-1863), (Paris 1962), p 513
- 86 Journal des Chemins de Fer, 5.VIII.1854, p 565.
- 87 Chambre de Commerce de Rouen, Exposé des travaux, 1853-1854, (Rouen 1855), p 17.
- 88 Procès-verbaux des séances de la Chambre de commerce du Havre, vol. 29, 3.III.1854.
- 89 Direction-général des Douanes, Tableau général du Commerce de la France.

90 Journal des Chemins de Fer, 2.VI.1855, pp 493-4.

91 Procès-verbaux des séances de la Chambre de commerce du Havre, vol. 31, 30.XI.1855.

92 Moniteur de la Marine, 19.IV.1856, 31.V.1856.

93 Chambre de commerce de Rouen, op. cit., 1855-1856 (Rouen 1857), p 15. This was the celebrated Affaire Vasse-Normand; the judgement rendered by the Tribunal du commerce de Rouen said in part, "...il ne suffit par, pour qu'il y ait égalité, qu'une même faveur soit offerte à tous les expéditeurs sous les mêmes conditions, mais qu'il faut que ces conditions imposées soit également accessibles à tous; qu'il est enfin dérisoire de prétendre qu'on présente à tous les chargeurs les mêmes avantages et qu'on les traite indistinctement et sans faveur, alors que l'on impose à la réduction du tarif des conditions impossibles pour le grand nombre de commerçants...." Dutard, op. cit., p 72.

94 Gazette des Tribunaux, 28-29.XIII.1857, Cour de Cassation (ch. civile), Bulletin du 28 déc.: "...Les autres expéditeurs, avec lesquels de semblables traités n'ont pas été passés, ne peuvent exiger d'être admis aux mêmes avantages qu'autant qu'ils acceptent les mêmes conditions."

95 Arch. Nat. F14.9440, "Tarif d'abonnement", June 1856. The comment of the Inspecteur principal de la 5e arrondissement des chemins de fer, 29.VI.1856, was "une excellente chose pour le commerce."

96 Moniteur de la Marine, 13.XIII.1857.

97 Ibid., 23.VIII.1857.

98 Ibid., 11.X.1857.

99 This commission is referred to in several places, e.g., Procès-verbaux de la Chambre de commerce du Havre, vol. 34, 27.XII.1857. It heard testimony from several chambres of commerce, the Syndicat national de la Marine, the railway companies, and others.

100 Moniteur de la Marine, 12.II.1860.

101 Archives départementales de la Seine-Maritime, Series S, Navigation de la Seine, dossiers du Conseil général (1856-1869), Rapport de l'ingénieur de la 4e Section de la Seine to the Prefect of the Seine-Inférieure, 1856.

102 Data for this have been taken from le Moniteur de la Marine; and from Chambre de commerce de Rouen, Statistiques de commerce maritime du port de Rouen, (Rouen 1844-1867).

103 Data for this table have been taken from le Moniteur de la Marine; and from Archives départementales de la Seine-Maritime, Series S, Navigation, statistiques des bateaux à vapeur naviguant sur les fleuves (1851-1860).

104 Moniteur de la Marine, 23.VII.1854.

105 Ibid., 3.IX.1854; the Cie Leloup-Ruel et Delisle was formed as a société en commandite par actions, for a period of ten years, with a capital of 1MF in shares of 1,000F each. Its official name was the Cie des Bateaux express de la Seine.

106 Ibid., 9.I.1853 and 16.I.1853.

107 Ibid., 15.XI.1857, states that the passengers owned by Louis Bertin et Cie are to be sold, and that the service they had operated had ceased some time before. No record of the number of passengers they carried has been found.

108 Ibid., 12.IV.1856; the Cie Louis Bertin was formed at LeHavre for a period of ten years, with a capital of 300,000F in 600 shares of 500F each.

109 Ibid., 24.V.1857.

110 Ibid., 17.VII.1859 and 13.XI.1859.

111 Archives départementales de la Seine Maritime, Series S, op. cit., and Le Moniteur de la Marine, 13.XI.1859.

112 Tourasse et F.-N. Mellet, Essai sur les bateaux à vapeur, (Paris 1828-1829).

113 Le Moniteur de la Marine, 7.VIII.1853; see also Arch. Nat. F14.*10912. 126, Procès-verbal du Conseil-général des Ponts et Chaussées, session of 5.VII.1853.

114 Le Moniteur de la Marine, 27.VIII.1853 and 6.XI.1853.

115 In 1854 Godeaux et Cie were given a concession to operate a system of touage from the écluse de la Monnaie (in Paris) to Pontoise; see Decret Impériale du 6 Avril 1854; Annales des Ponts et Chaussées (Lois et ordonnances 1854), p 345; see also Arch. Nat. 65AQ.Q497, Cie de Touage de la Basse-Seine et de l'Oise, Société anonyme.

116 Chambre de commerce de Rouen, Statistiques de commerce maritime du port de Rouen, (Rouen 1844-1867), 1863 and 1867.

117 Le Moniteur de la Marine, 24.VI.1860 and 30.IX.1860.

118 Chambre de commerce de Rouen, op. cit., 1864.

119 See Clément Colson, Transport et Tarifs, (Paris 3 Edn. 1908), pp 142-143.

CONCLUSION

1 Louis Girard, "Transport", in Cambridge Economic History of Europe, vol 6, The Industrial Revolution and After, Part I, (Cambridge 1965), pp 212-213.

BIBLIOGRAPHY

A. Manuscript Sources

1. Archives Nationales.

(a) The most useful series was F14 (Ponts et Chaussées):

F14.*10912, Procès-verbaux du Conseil-général des Ponts et Chaussées (1830-1860)

F14.*10916-918, Procès-verbaux de la Commission de la Navigation (1830-1832)

F14.*10983-11041.1, Procès-verbaux de la Section de la Navigation (1832-1850)

F14.*11041.3-.32, Procès-verbaux de la Section de la Navigation (1851-1860)

F14.*11041.61-.67, Procès-verbaux de la Section des Chemins de Fer (1843-1860)

F14.*10914-15, Procès-verbaux de la Commission des Routes (1830-1832)

F14.1633, 1642, 1646, 1964, 11141 (Roulage).

F14.544, 708.1, 1187, 1269, 1270, 6812, 6813, 6814, 6815, 6816, 6817, 6820, 7105, 7106 (Navigation).

F14.8552, 8862, 8863, 9435, 9436, 9440, 9441, 9997, 9998, 10004, 10005 (Chemins de Fer).

F14.2173.1, 2206.1, 2215.1, 2283.1, 2302.1 (Personnel)

(b) A second very useful series was F12 (Commerce et Industrie):

F12.7600 (Réponses des Chambres consultatives à la circulaire du 3 Juin 1848).

F12.7598, 7599 (Correspondence du Ministre).

F12.2615A, 2615G, 6065, 6764, 6765, 6770, 6771, 6818 (Sociétés Anonymes).

(c) Series AP (Archives Privées):

42.AP.172, 1-9 (Fonds Guizot); with the kind permission of M.Marc Schlumberger.

(d) Series AQ (Archives Economiques):

76.AQ.4, 76.AQ.5, 76.AQ.6, 76.AQ.7, 76.AQ.9 (Rapports aux Assemblées généraux d'actionnaires) for Paris-to-Rouen, Rouen-to-LeHavre, Rouen-to-Dieppe, and Cie de l'Ouest.

(e) Series BB (Justice):

BB.17A.136, BB.18.1400, BB.21.519B, BB.24.251-285; these contain several items, mostly concerning attacks against railway property, and strikes.

(f) Series C (Corps législatif, 1852-1870):

C.1027 (Amélioration de la Seine-Maritime).

(g) Series CC (Assemblées législatives, 1800-1848):

CC.394.1801 (Chemin de fer Paris à Rouen).

CC.2210.240, CC.394.1792, CC.399.1836 (Amélioration de la Basse Seine). CC.394.1795 (Roulage)

2. Archives départementales de Seine-Maritime

Unfortunately no catalogues have yet been prepared for the documents in these archives in the post-Revolutionary period. Though difficult to use however, they are a fairly rich source on economic and social history. I would like to thank Mlle Jouen and others on the staff of the archives in Rouen for the great assistance given me in locating documents.

(a) Two series were used, the first of them Series M (Administration générale); this series contains much statistical material on commerce and industry from the Revolution to the late nineteenth century. The following is a partial list, showing only those bundles found to be useful for this thesis:

M. Statistiques industrielles et commerciales, enquêtes (1820-1837).

M. Statistique générale de la France (essai de statistique rurale) (1820-1845).

M. Statistiques. Commerce, navigation, industrie, agriculture (1830-1848)

M. Statistiques industrielles (1840-1852)

M. Statistiques industrielles (1842-1847)

M. Statistiques industrielles (1861-1865)

M. Mouvement des ports (1830)

M. Mouvement des ports (1837-1838)

M. Mouvement des ports (1846)

M. Mouvement des ports (1848)

M. Douanes, entrepôts, docks et magasins généraux, arrondissement du Havre (An IX-1860)

M. Commerce, société anonymes des Paquebots à vapeur (1830-1836)

M. Faillites (1806-1840)

M. Chambre de Commerce du Havre (1806-1830)

M. Chambre de commerce, ville du Havre, matières diverses (AnX-1831)

M. Chambre de commerce du Havre, affaires générales (1809-1872)

M. Chambre de commerce du Havre, affaires générales (1820-1881)

(b) Series S (Travaux Publics):

S. Ponts et chaussées, navigation, ports, affaires générales, budgets (1806-1830)

S. Navigation de la Seine; dossier du Conseil général (1856-1870)

S. Navigation de la Seine, dragages (3 liasses)

S. Navigation de la Seine, amélioration, affaires diverses

S. Navigation de la Seine, compagnies de transport accéléré de marchandises (A-Z)

S. Navigation, statistiques bateaux vapeur naviguant sur la mer (1847-1860)

S. Navigation, statistiques des bateaux à vapeur naviguant sur les fleuves (1834-1850)

S. Navigation, statistiques des bateaux à vapeur naviguant sur les fleuves (1851-1860)

S. Navigation de la Seine, affaires diverses (B-C)

S. Navigation de la Seine, affaires diverses (D)

S. Navigation de la Seine, affaires diverses (G-Pg)

2. Archives départementales de Seine-Maritime

Unfortunately no catalogues have yet been prepared for the documents in these archives in the post-Revolutionary period. Though difficult to use however, they are a fairly rich source on economic and social history. I would like to thank Mlle Jouen and others on the staff of the archives in Rouen for the great assistance given me in locating documents.

(a) Two series were used, the first of them Series M (Administration générale); this series contains much statistical material on commerce and industry from the Revolution to the late nineteenth century. The following is a partial list, showing only those bundles found to be useful for this thesis:

M. Statistiques industrielles et commerciales, enquêtes (1820-1837).

M. Statistique générale de la France (essai de statistique rurale) (1820-1845).

M. Statistiques. Commerce, navigation, industrie, agriculture (1830-1848)

M. Statistiques industrielles (1840-1852)

M. Statistiques industrielles (1842-1847)

M. Statistiques industrielles (1861-1865)

M. Mouvement des ports (1830)

M. Mouvement des ports (1837-1838)

M. Mouvement des ports (1846)

M. Mouvement des ports (1848)

M. Douanes, entrepôts, docks et magasins généraux, arrondissement du Havre (An IX-1860)

M. Commerce, société anonymes des Paquebots à vapeur (1830-1836)

M. Faillites (1806-1840)

M. Chambre de Commerce du Havre (1806-1830)

M. Chambre de commerce, ville du Havre, matières diverses (AnX-1831)

M. Chambre de commerce du Havre, affaires générales (1809-1872)

M. Chambre de commerce du Havre, affaires générales (1820-1881)

(b) Series S (Travaux Publics):

S. Ponts et chaussées, navigation, ports, affaires générales, budgets (1806-1830)

S. Navigation de la Seine; dossier du Conseil général (1856-1870)

S. Navigation de la Seine, dragages (3 liasses)

S. Navigation de la Seine, amélioration, affaires diverses

S. Navigation de la Seine, compagnies de transport accéléré de marchandises (A-Z)

S. Navigation, statistiques bateaux vapeur naviguant sur la mer (1847-1860)

S. Navigation, statistiques des bateaux à vapeur naviguant sur les fleuves (1834-1850)

S. Navigation, statistiques des bateaux à vapeur naviguant sur les fleuves (1851-1860)

S. Navigation de la Seine, affaires diverses (B-C)

S. Navigation de la Seine, affaires diverses (D)

S. Navigation de la Seine, affaires diverses (G-Pg)

S. Chemins de fer de l'Ouest, ligne de Paris à Rouen et au Havre, affaires générales. (1825-1854)

S. Chemins de fer de l'Ouest, ligne de Paris à Rouen et au Havre, matières diverses, (D&E). (1840-79)

S. Chemins de fer de l'Ouest, ligne Paris-Rouen-LeHarve, matières diverses, (I&O). (1843-1853)

S. Chemins de fer de l'Ouest, ligne Paris-Rouen-LeHarve matières diverses. (1842-1863)

S. Chemins de fer de l'Ouest, ligne Paris-Rouen-LeHarve ville de Rouen, affaires diverses. (1841-45)

S. Chemins de fer de l'Ouest, ligne Paris-Rouen-LeHarve, affaires générales. (1833-1840)

3. Archives de la Chambre de Commerce et d'Industrie du Havre

Useful material was found in several bundles in the 'archives anciennes', which include a total of 25 bundles covering from early in the eighteenth century up to about 1865. There is a further much larger collection of documents for the years from 1924 to 1940. Both series are well classified. Of particular value in the preparation of this thesis was the collection of manuscript "Registres des délibérations de la Chambre de Commerce", which extend from 1802 to the present; they are indexed from 1832. I should like to thank the conservateur des archives, M. Momillon, for the great assistance he so kindly gave me in finding the documents I needed.

4. Archives de la Chambre de Commerce de Rouen:

These were formerly a very good source of material on the nineteenth century; unfortunately they were almost totally destroyed by aerial bombing in 1944. One important document was discovered.

5. Archives de la Ville du Havre:

There was a small amount of useful material here, in series F (Administration, commerce et industrie), I (Routes), and O (Travaux Publics). See L. Préteux, Répertoire Numérique des Archives Communales, Fonds Moderne, 1800-1870, (LeHavre 1934).

6. Archives de la Ville de Rouen:

The document formerly kept in these archives were almost totally destroyed by fire in 1926. Nothing of any use was found among what remains.

7. Bibliothèque Nationale:

Section des Cartes et Plans.

8. Flintshire County Record Office (Hawarden, Nr Chester):

This was the home of William Buddicom. His papers have deposited with the County Record Office as FRO. 135.

9. British Transport Historical Records:

Reference was made to the Journal of the London and Southwestern Railway Company, series LSW.

Unfortunately none of the records of any of the original

three railway companies in the Seine valley (the Paris-to-Rouen company, the Rouen-to-LeHavre company, and the Rouen-to-Diepe company) have survived. Nor are there any surviving records from the river transport companies which operated during the four decades before 1860.

B. Contemporary Published Sources

1. Government Documents

Almanach Royal, later Almanach Royal et National, later Almanach Impériale.

Bulletin des Lois.

Le Moniteur universel.

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